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New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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Vol. VIII. NEW YORK, NOV. 13, 1886. No. 20.

IT is a great pity that the arrangements to light up the Statue of Liberty have been so badly muddled and mismanaged. There seems to have been unnecessary confusion and misunderstanding. The best way out of the present difficulty, which leaves Liberty in eclipse, is to let Mr. Goff, the President of the American Electric Manufacturing Company, which gave the lighting apparatus, have permission, as he desires, to light the statue at his own expense for the present, with privilege to experiment as to the best disposition of the lights.

WE are indebted to Mr. H. Ward Leonard, of the Western Edison Company, for some very interesting data in regard to the Oskaloosa, Iowa, station, given in this issue. We shall be glad to have like figures from any other quarter. It deserves mention, too, that the station named is running a number of Sprague motors with great success.

THE work of providing New York City with electrical subways has been full of surprises. The latest event to excite interest and curiosity is the resignation of Mr. Roswell P. Flower as a Commissioner and as the President of the Board. In a letter to Governor Hill, given in full on another page, Mr. Flower states his reasons for resigning and furnishes an account of the work already accomplished. Unquestionably Mr. Flower has done his share of the task with credit in a forcible, practical, business-like way, but his successor in the presidency will have to "put his shoulder to the wheel" if the wires are all to go under ground within the present century. Mr. Flower, who is a man with large private interests to manage, has evidently found the work makes too great a demand on his time, and it is to be hoped that the next man to have direction of the undertaking will not only have energy, but be able to devote himself to the duties of the Commission.

ANTICIPATING the time, if it has not already arrived, when the City of London will be in the same condition, regarding overhead wires, as New York is at present, the question of burying the wires is being taken up, and recently a working example of an underground system, on the Callender-Webber plan, has been put on exhibition there. One of our London contemporaries, after viewing the plant, takes the opportunity of predicting the utter failure of the conduits lately laid in New York, basing its criticisms principally on the quality of the material employed. It claims that the Subway Commission was deaf to the advice of certain parties, and that the work will prove defective in a short while. Whether this will turn out to be a fact, time alone can tell, but it is pertinent to remark that more than one system will be tried, and that experience gained from each will be the guide for extensions. Then, again, the continued success of the Chicago underground conduits, of substantially the same material as that being employed in New York, speaks well for its durability.

THE only incandescent light central station in Holland, that at Kinderdijk, is most extraordinary in character. It is situated in a small village where gas was once used, but the pipes rusted away in the damp soil, and the company took up electric lighting as their only alternative. The house for engine, boiler and dynamo is surrounded by water, and the building stands on piles. It was found that the vibration was quite perceptible and hence a boat-load of sand was dumped underneath the building, which remedied the evil entirely. It is a 400-light Edison plant and is now running in fine order. The service is used by the most humble, whose wages are not higher than five francs a day, and the price charged makes it probably the cheapest electric light in the world. The company are only allowed to pay 5 per cent. per annum, the surplus going toward increase of plant. The capital invested is about $3,000. The price of lighting up to 12 P. M. varies with the number of lamps from $2.57 per annum for one 16-candle lamp, to $2.12 each per annum for 20 lamps. It is somewhat striking that the same trouble with rusting gas pipes is experienced alike in the marshes of Kinderdijk and the lofty table-land of the City of Mexico.

IN comparing the different systems of transmitting motive power, M. Jules Lauriol, in *Le Génie Civil*, draws an impartial comparison between the cost as dependent upon the method of transmission employed, including transmission by water under pressure, compressed air, telodynamic cable, coal gas (gas engines), steam and rarefied air. He goes over the advantages and disadvantages of each, but shows in a table of results that electricity is undoubtedly the cheapest of all. In summing up, M. Lauriol says: "The transmission of motive power by electricity has every claim to be recommended and employed, firstly, because it is of wider scope than transmissions based upon the continuous displacement of any material substance (gas, steam, air, or water) from the place of its production to the place where the energy is to be employed, and then because of its undoubted superiority and convenience in use. The energy is transformed into heat only for such applications as require it, and it is superior even to gas in such cases as require the concentration of a great quantity of air at a given point and for the conversion of heat into light. Where mechanical work is required, the energy passes directly from the electrical to the mechanical state by means of apparatus less costly, less bulky, and easier to manage than the simplest appliances necessary for effecting the same object. As for distribution, properly so called, the natural superiority of electricity is at once manifest." The facts here stated have, we believe, already been sufficiently proved in practice, but it requires time to bring about their universal recognition.

THE success already obtained in long-distance telephony, as brought out in an article in another column, is a sad commentary on the condition in which apparatus for "short-distance" telephony is allowed to remain. It may well be asked why these same improvements used in long-distance telephony are not at least in part applied to the amelioration of telephonic service within cities. It would be making too bold a statement to assert that apparatus of this class in present use is perfect. Although it is allowed to continue in service, the admission that better and more powerful apparatus exists, is equivalent to the confession that the large majority of telephone subscribers are compelled to use inferior instruments. We are well aware that innovations would entail heavy expense, but we are convinced that the time has come when better service can, and ought to, be given as the result of ten years' experience in this field. Probably the only changes which have taken place in that time are to be found in central office apparatus and management, facilitating rapidity of connection. Hence we may reasonably insist that the quality of communication ought now to be looked after and brought up to the "long-distance" standard, by the use of the self-same methods and instruments.

THERE can be no doubt that much time is wasted by persons of an inquiring mind in the perusal of scientific books that have gone out of date in more ways than one. For historical and antiquarian, or bibliographical purposes, it is interesting to own or have access to old works on scientific subjects, but if the desire be to know what the world is doing to-day it is imperatively necessary to have the latest productions of the press. We have been very much pleased by an able and suggestive paper read before the Library Association by Miss C. M. Hewins, bringing out this point very forcibly. Speaking of the discrimination to be exercised by librarians in buying books so as to suit the readers, whose intellectual growth they should stimulate, she says: "A town with telephones, electric lights, machine-shops and manufactories, where many young men of intelligence are electrical engineers, machinists and draughtsmen, needs all the newest books that it can afford to buy, on electricity, applied mechanics and mechanical drawing. We find in Hartford a steadily increasing demand for books of these classes. Scientific works, unless of recent date, are worse than useless, except to a student of the history of science. A person who asks for a book on physics or chemistry from a printed catalogue does not always notice the imprint, and chooses a work quite out of date. A librarian can and should tell him where to find a newer and better one. The use of books on special subjects grows every year." Miss Hewin's paper dealt with the question of how to make the best use of a small library, and it will at once be appreciated that in the case of a library possessing but a few hundred books, this caution is one of the weightiest. Very few public libraries to-day are complete without a scientific section, and the best books in that will generally be the latest—best because they are freshest.

THE interesting facts brought out by Mr. W. E. Irish on another page, in which it is shown that, when using frictional machines, contiguous wires connected with explosive charges might act upon each other by induction to a dangerous degree, recall the late voluminous report of the English Accidents in Mines Commission, which contained the result of very exhaustive inquiries and experiments made by the commission with a view to the prevention of the frightful explosions periodically occurring in many coal mines. They laid great stress upon the danger caused by the naked flame which must be present at the explosion of a shot, and which, coming into contact with any explosive gas that may be at hand, would be sure to ignite it. They recommended the use of certain explosives in lieu of gunpowder which, fired under stated conditions, can give off no flame. To explode these shots they named electricity in the following emphatic terms: "Electrical exploding appliances present very important advantages from the point of view of safety over any kind of fuse which has to be ignited by the application of flame to its exposed extremity, as the firing of shots by their means is not only accomplished out of contact with air, but is also under most complete control up to the moment of firing. Their simplicity and certainty of action have been much increased of late years, while their cost has been greatly reduced, and but little instruction is now needed to insure their efficient employment by persons of average intelligence." Thus when electricity is so highly recommended for the purpose, it is well that attention has been drawn to a source of danger attending some kinds of the apparatus. The frictional electric machine is, we believe, not infrequently used abroad for military and civil engineering purposes, but is comparatively unknown on such work in this country, where the magneto or battery exploders are in general use.

Equivalence of Chemical Energy and Current Energy.

H. Jahn, in the *Ann. Phys. & Chem.*, gives an account of some experiments in which he proves Helmholtz's relation between the secondary heat of a galvanic element and its temperature coefficient. The elements examined were silver in silver nitrate, with lead in lead nitrate, and copper in copper nitrate respectively. The solutions had a strength of $(M')_2(NO_3)_2 + 100H_2O$. The chemical heat of the cell is obtained from the formula $Q = W - aJ(\Delta Jg)t$, where W is the heat evolved in cell, a the heat equivalent of unit of work, J the current intensity in ampères, $\Delta - Jg$ the potential difference of poles, and t the duration of the experiment. The values obtained from this formula agree closely with those obtained from thermo-chemical data. The chemical heat less the current heat gives the secondary heat, which is compared with that obtained by calculation from Helmholtz's relation. The following are the results:

Element.		E. M. F.	Chemical heat.	Current heat.	Secondary heat. found.	Secondary heat. calc.
$Ag_2, Ag_2(NO_3)_2$	$Pb(NO_3)_2, Pb$	0.932	50.87	42.98	7.95	7.89
$Ag_2, Ag_2(NO_3)_2$	$Cu(NO_3)_2, Cu$	0.458	30.04	21.12	8.92	8.92

On a New Scale for Tangent Galvanometers.*

BY W. H. PREECE, F. R. S., AND H. R. KEMPE.

Tangent galvanometers are much used for the exact quantitative measurement of currents of considerable strength, such as are measured in ampères, but they are not so generally used for the measurement of smaller currents in milliampères. This arises from a notion that they are not sensitive enough, although the most sensitive instrument in practice—Sir William Thomson's mirror galvanometer—is really a tangent instrument. The ordinary forms, Joule's, Gaugain's or Helmholtz's, are not very sensitive. Their constant is about 3; that is, 3 ampères are required to produce the unit deflection of 45°. The post-office has for many years used a more sensitive and portable form, having a constant of .00214 for testing wires, batteries and apparatus.

Fig. 1 shows in elevation the general form of the instrument.

Fig. 2 is a general plan of the arrangement of the coils, etc.

The ring, which is 8 inches in external diameter, has three coils of wire wound on it. The one nearest the needle is of No. 35 wire, and is wound to a resistance of 320 ohms approximately. The other two coils are of No. 18 gauge; the one between *C* and *D* making three turns, and the one between *D* and *E* making 12 turns in the opposite direction. The latter coils are for testing batteries; by using terminals *C D*, *D E*, or *C E*, respectively, relative degrees of sensitiveness of approximately 1, 3 and 4 can be obtained. An adjusting magnet, similar to that used on the ordinary Thomson mirror galvanometer, is set on the upper part of the ring as shown. In testing the strength of a current in milliampères by means of the instrument, a standard Daniell cell is connected between terminals *A* and *B*; both plugs being removed from the plug holes *a*, *b*, there is in circuit a total resistance of 1,070 ohms, viz., 750 + 320. As the electromotive force of the standard cell is 1.07 volt, the resulting deflection (30°) of the galvanometer needle will be due to a current of 1 milliampère. By means of the adjusting magnet this deflection can be increased or diminished as required. In practice, the adjustment is such that 1 milliampère of current gives a deflection of 80 divisions on the ordinary tangent scale. When the measurement of a current is to be made the plug *A* is usually inserted so as to cut out the 750 ohms resistance. Plug *B* inserts a $\frac{1}{10}$th shunt.

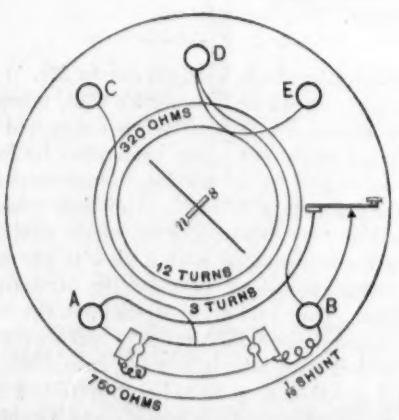


FIG. 2.—NEW TANGENT GALVANOMETER.

Hitherto *two* scales have been engraved on the dial, the one divided in degrees and the other in tangent divisions; and to avoid parallax the indicator is reflected in a mirror, so that when the image and the indicator are in one line no error from this cause occurs. Where observations are made by reading deflections serious errors arise from parallax, especially where the law of tangents is followed.

Mr. Eden, one of the assistant electricians of the Post-Office, discovered, while experimenting, that the galvanometer could be made more sensitive to increments of current for high deflections if it were given a false zero. In fact, if the instrument be "slewed" round so that the plane of the coil makes an angle of 60° with the meridian, then the instrument becomes twice as sensitive as it was before. and he suggested a double scale, such as is shown in the accompanying figure, to utilize this fact. This plan has been adopted, and all tangent galvanometers in the Post-Office service will be gradually altered to the new scale.

It is quite clear that the instrument owes its increased sensitiveness to the fact that when the needle reaches its maximum deflection, its angle to the lines of force of the field is the one most favorable for the deflection of the needle by the current. In fact, the plane of the coils becomes parallel to the plane of the needle, which is then in the most *uniform* portion of the field.

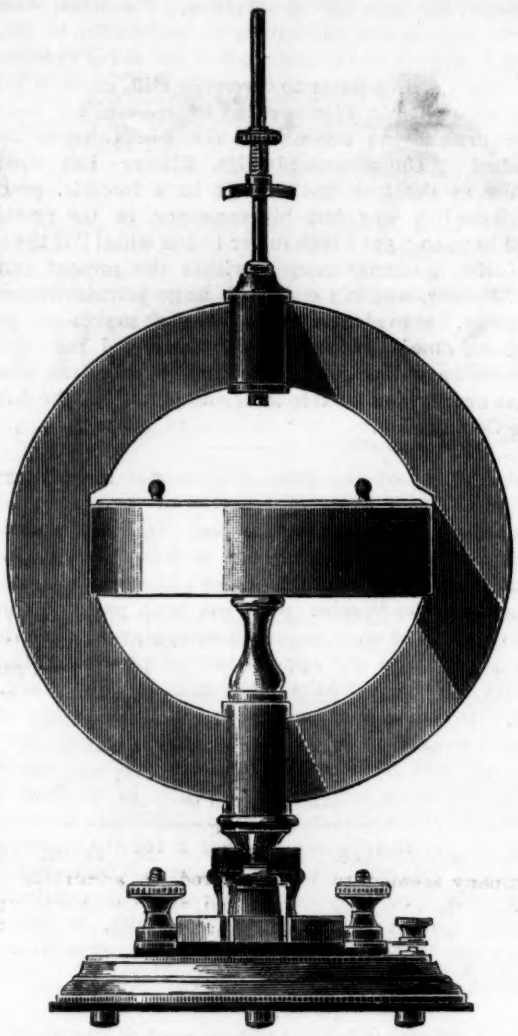


FIG. 1.—NEW TANGENT GALVANOMETER.

By thus changing the zero of the instrument the range of movement can be considerably increased; thus if $\beta°$ be the angle which the needle normally makes with the coil, and if $\alpha°$ be the angle to which the needle has been deflected on the other side of the coil, then the strength of a current is directly proportional to $(\tan \alpha° + \tan \beta°)$, which is the reading on the tangent scale if the figures on the latter are rearranged so that the zero is at the division at which the needle points in its normal position.

Now if we have $\beta° = 60°$, and if the current be sufficient to turn the needle through $2\beta°$ or 120°—that is, if we have $\alpha° = 60°$, the angle through which the needle would have been turned when the zero was 60° to one side of zero would be twice what it would be if it had been deflected from the ordinary zero. The ratio of these angles, however, decreases in value, and at a certain point becomes equal to 1; that is to say, the angular deflection from the new zero is the same as it is from the old zero.

Whatever be the angle $\beta°$ (the angular distance of the new from the old zero), then a current sufficient to move the needle a distance of $\frac{\beta°}{2}$ from the old zero would move the needle the same distance from the new zero. If the deflection from the old zero be less than $\frac{\beta°}{2}$, then the deflection from the new zero will be less still, so that there is no advantage in the use of the new zero unless the deflections exceed $\frac{\beta°}{2}$.

If the angle $\beta°$ be made greater than 60°, then the possible angular movement of the needle becomes still further increased; but inasmuch as any increase in the length of the tangent scale brings the division at the ends of the scale proportionally closer together and more difficult to read from, there would be no practical advantage in making the angle larger. A marked advantage, under certain conditions, is found when the new zero has such a value that the deflection from a given current causes the needle to turn up to the ordinary zero—that is to say, to the position where the needle becomes parallel to the coil; in this case the instrument becomes highly sensitive, and any increase in the strength of the current produces a very considerable change in the deflection.

It might then seem that the greater $\beta°$ is made the better; but there is a practical limit to this increase, for the larger we make β the more does the deflective action of the coil tend to act in a direction parallel but opposite to the earth's magnetism, the consequence being that the resultant of the two forces is a comparatively small quantity, and the friction of the pivot, etc., prevents the needle from settling down to the true angle representing the force of the current. Under such conditions, very large errors in the readings may result. Were it not for this fact, the instrument would increase in actual sensitiveness up to that point at which $\beta° = 90°$, at which point the needle would not move unless acted upon by a current exceeding in deflective force the intensity of the earth's magnetism; when the current exceeded this value the needle would swing completely round through an angle of 180°.

*In presenting the description of this instrument to the British Association Mr. Preece said he would not read the full paper, as Sir William Thomson had just informed him that he invented and patented a precisely similar instrument three years ago. (Abstracted.)

Liberty's Temporary Eclipse.

Now that the great Bartholdi Statue of Liberty has been handed over to the Government, as represented by the Lighthouse Board, it appears that no funds have yet been provided by Congress for keeping the torch alight. There are several persons, however, who have signified their willingness to furnish funds to run the engine, and Mr. Edwards H. Goff, President of the American Electric Manufacturing Company, still offers to have the electric lights attended to until Congress shall make a necessary appropriation, and E. P. Hampson & Co., who supplied the steam plant, have also been generous in their action and offers. Gen. Schofield states that applications to furnish means to light the torch would have to be made to the Secretary of War, as he had no right to authorize the illumination by such means. The American Committee says the matter of lighting the statue has passed out of its hands.

A special dispatch from Washington says: There appears to be a misapprehension as to the connection of the Lighthouse Board with the Bartholdi Statue of Liberty. It is stated at the Treasury Department that the Lighthouse Board, as such, has no authority over the statue, no connection with it, no power to light it, and no money to expend in lighting it if it had any power in the matter. A prominent officer of the board in speaking on the subject said: "General Schofield was placed in charge of the inauguration of the statue by Executive order. He, in that capacity, asked the Lighthouse Board for the loan of certain electric lighting apparatus and of certain persons on duty at the lighthouse station on Staten Island, in assisting at the inauguration of the statue. Whereupon it was ordered by the board, at its meeting on Oct. 15, 1886, that the request be granted, on condition that no expenditure be made from lighthouse funds for that purpose. Under this order Lieut. John Millis, Corps of Engineers, United States Army, who is on duty at the Lighthouse Board's depot at Staten Island, and who is in charge under General Duane, the engineer of the Third Lighthouse District, of the electrical lighting apparatus, was ordered to report to Gen. Schofield for duty in connection with the inauguration of the statue, and certain apparatus was loaned by the Lighthouse Board to Gen. Schofield for that purpose. What Lieut. Millis has done in connection with the lighting of the statue was done under the orders of Gen. Schofield, was paid for by moneys placed at his disposal by Gen. Schofield, and with what he has done, or has failed to do, the Board has no connection whatever. The Board has recently been obliged to order the discontinuance of the electric light at Hell Gate in view of the complaint made against it by those navigating the Sound, they claiming that the light dazzled their eyes to such extent that it was a hindrance rather than a help, and at times a positive danger to navigation. Under these circumstances, if the Board had the power, which it has not, and the means, which it has not, to so light the Bartholdi statue as to have it seen from the sea, it would be disinclined to do so, lest it should be an interference with the system now in operation and lest, too, it should be styled a hindrance rather than a help, and a danger to navigation."

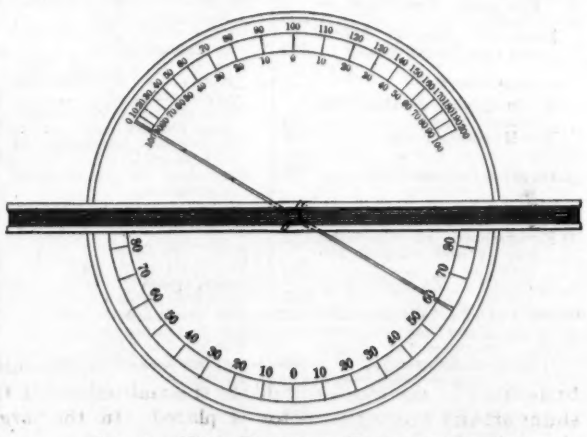


FIG. 3.—NEW TANGENT GALVANOMETER.

As to the effects obtained with the lighting apparatus as at present disposed, the general opinion is that a failure has been made. M. Bartholdi is said to consider the torch-lighting a success, and it is also asserted that on a

clear night the "flame" is visible thirty miles out to sea, across Sandy Hook. But the public are disappointed, and electricians, almost without exception, think that with such a body of light as the lamps give out, far better illumination is possible.

The Edgerton Motor.

Among the most prominent of the electric motors in general, practical use is the Edgerton, designed by Mr. N. H. Edgerton, of Philadelphia, and shown in perspective in the accompanying engraving, Fig. 1.

The pole-pieces, Fig. 2, are arranged each with three radial cores, on which the exciting coils are wound, and by which the fields are supported on the interior of a cylindrical iron shell which forms the framework of the motor, as well as the yoke-piece of the field magnets. The shell and pole-pieces form a concentrically cylindrical structure in the interior of which the armature revolves on a central shaft supported at either end by bearings situated centrally in the end caps or lids. These end caps may close the cylinder entirely or not, but usually one end is closed completely while the other is left open, as shown, for easy access to the brushes and commutator.

The armature shown in section in Fig. 2 is polar, and consists of three helices, wound upon as many radial cores, set at equal distances upon a central prism of the same number of sides. Through the central axis of this prism the shaft is placed longitudinally, and, as before stated, supported in bearings in the end caps of the motor. The outer or peripheral extremity of each of these cores is segmental in shape, coinciding in curve with the inner, concave surfaces of the pole pieces between which it revolves. The helices are wound parallel with the axis of the armature as in the Siemens shuttle armature, and each is complete in itself. Similar ends of each helical wire are connected with the commutator segments, of which there is one for each helix; and the other similar ends are carried out to a common union, insulated from and carried upon the shaft.

It has been the aim of the inventor to design his motor on such mechanical lines as would insure cheapness and simplicity of construction with least cost of maintenance. To this end the covered cylindrical form was adopted, as it furnishes bearings of the greatest solidity and protects completely the operative and vital parts of the motor, thus allowing of its use, without injury, in the most exposed situations. The division of the field magnet coils into three helices for each field was adopted as the most likely way to prevent undue heating in the motor circuit, in addition to which the shortness of the cores abutting immediately upon the large surface of the outer shell furnishes, by conduction and radiation, a ready means for the dissipation of all such heat.

The polar armature was chosen by Mr. Edgerton on account of its ease of construction, and because the peripheral segments of the spools on which the helices are wound make it impossible for the motor, at its highest speed, to displace any of the wires by "tangential inertia;" further, because in the rise of temperature in the motor due to flow of current, while in operation the coefficient of expansion is the same both in armature and field, which, of course, allows of the rotation of the armature in closer proximity to the pole pieces, and, lastly and principally, because, according to Mr. Edgerton, the inductive action of the field is received first by the iron core and transferred through that to the wire, thus reducing the resistance of the armature circuit, due to counter electromotive force.

The armature is connected in series between the fields in the small motors, although it is perfectly feasible to place it in a shunt. When the machine is coupled in series and in operation, the current is active at all times in two of the helices and momentarily in each revolution in all three.

In the smaller sizes, the speed of the motor is regulated by means of resistances included in the main circuit in the shunt around which the motor is placed. In the larger sizes, viz., from one horse-power and over, a centrifugal governor is arranged for maintaining a uniform rate of speed. With this size also the armature and commutators are changed from three to five segments; while, in those still larger, provision is made for one brush only on the commutator, while the other brush is transferred to the insulated ring of the bobbin union. As all the armature bobbins are coupled in multiple arc with this ring, it results, as a matter of course, that, with the commutator slits cut diagonally, the sparking at the commutator is reduced to a minimum.

The Paris Exhibition of 1889.

The *Journal Officiel* contains the following list of names of those who will form the Committee of Electro-technics for the International Exhibition of 1889: MM. Ed. Becquerel, Alf. Cornu, Marcel Deprez, Maurice Lévy, Lippmann, Maurice Lœwy, Mascart, le Colonel Perrier, membres de l'Institut; Armengaud, membre du Conseil Municipal de Paris; Baille, Bartet, Bergon, Blavier, Caël, Carpentier, Chatard, Fontaine, Fribourg, Hospitalier, Huet, Joubert, Jousselin, Lemonnier, Ménier, Mercardier, de Méritens, Napoli, Gaston Planté, Postal-Viney, Potier, Raynaud, Richard, Ed. de Rothschild, Sartiaux, Sciama, le Colonel Sebert, Violle, Vivarez. The appointment of secretary to the committee has not yet been made.

Work on the New Subways.

At the meeting of the Subway Commission, held last week, Mr. Gibbens, the counsel, read an official notice ordering the telegraph and telephone companies to duplicate their service in the Sixth avenue conduit, which will be completed from Twenty-first to Fifty-ninth streets about Nov. 15, and to remove their poles before Jan. 1, 1887. This notice was formally adopted. The Manhattan District Telegraph Company was denied a permit for temporary wires because it had no recognition from the Department of Public Works. Permission was granted for

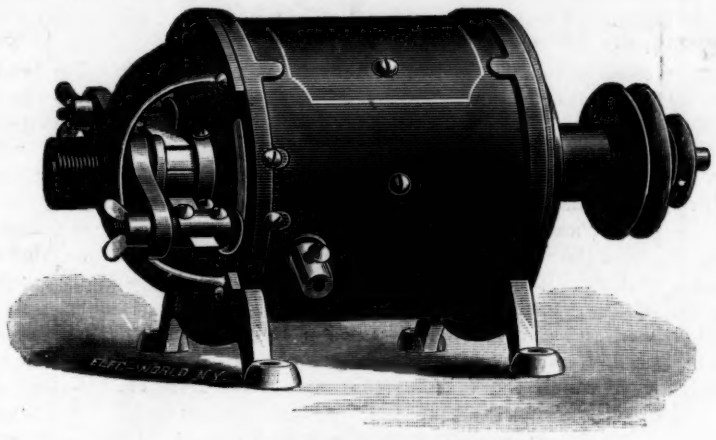


FIG. 1.—THE EDGERTON MOTOR.

a private underground electric light cable between the residences of D. O. Mills, No. 634 Fifth avenue, and Whitelaw Reid, at Fiftieth street and Madison avenue. It was announced that the Controller had already paid part of the salaries of the Brooklyn Commissioners and would soon satisfy the claims from New York.

Dr. Ledoux, the chemist of the Commission, reported that the companies with patent materials had been slow in sending in their samples, and then Mr. Lauterbach, as the head of the Construction Company, proceeded to show what was to be done. He declared that, as the Averell Company seemed to have secured an admirable paper tube, if the commission approved, the cross-town conduit for the telephone company on Fifty-seventh or Fifty-ninth street would be made according to the Averell system instead of with hydraulic cement. Commissioner Hess spoke favorably of the practical operation of the Averell

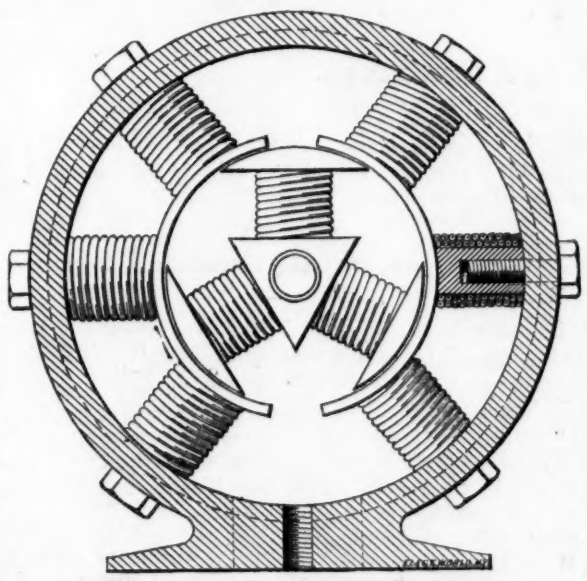


FIG. 2.—END VIEW OF EDGERTON MOTOR.

system in Washington, and the plan was formally referred to the engineer.

The next section proposed was a 30-duct conduit, to be laid from the corner of Cortlandt street up Broadway to Mail street, and through Mail street to the Brooklyn Bridge. Mr. Brown said that the Western Union Company would occupy it at once, and had spoken for six ducts. Mr. Beckwith said that the telephone company would require 12 ducts. This application was granted on condition that the poles come down, and plans and specifications are to be reported by the engineer this week.

Mr. Lauterbach said that conference with the telegraph and telephone companies showed that they preferred Broadway as an underground route southward, and that the Western Union Company would probably enter into an arrangement to grant the use of its trench, or that perhaps the proposed conduit would work in conjunction with the Western Union iron pipes already laid. This was also referred to the engineer to select materials and to report.

Mr. Lauterbach then announced that the Construction Company would build the section from Broadway and Spring street, to the North River, for the Metropolitan Company, of three iron pipes imbedded in asphaltic concrete, one of the pipes to be prepared on the Brooks system, which the Metropolitan Company now employs. The engineer was again told to prepare plans, Mr. Lauterbach remarking with satisfaction that the rental had been guaranteed.

In response to a request from Commissioner Newton, of the Department of Public Works, Corporation Counsel Lacombe has given his opinion that a permit from the department to string telegraph or other wires on supports across private property in the city was not necessary where the permission to do so had already been granted by the Electrical Subway Commissioners.

The application of the New York Underground Telegraph Company for an injunction restraining the board of police commissioners and their subordinates on the police force from interfering with the men employed by the company to lay conduits in the streets was argued before Judge Ingraham in the Superior Court on Nov. 5. John R. Dos Passos, who made the application, stated that the company received a special charter on May 16, 1873, authorizing the construction of telegraph lines partly or wholly underground, provided permission was obtained from the commissioner of public works for the laying of the lines in this city. The company obtained permission from the department of public works in 1883, and filed its bond. The first work was begun on Saturday night, Oct. 30 last, but the police interfered with the laying of the conduits, and arrested the general manager of the company and one of the workmen. It was to prevent such police interference that the injunction was desired. Mr. Dos Passos contended that the men arrested and charged with having opened the streets without permission of the subway commissioners had committed no crime. The acts of 1884 and 1885, he urged, contemplated the removal of the poles and wires from the streets of the city, but had no reference to making a monopoly of the franchise of placing the wires under ground and killing competition. The subway commissioners, he said, had no more right to stop the operations of the underground company than to interfere with gas or steam-heating companies. Corporation Counsel E. Henry Lacombe opposed the application, stating that seven justices had already decided that such relief as that asked for does not lie in the power of a court of chancery. Judge Ingraham, after remarking that if the object was to enjoin the police from arresting criminals, he was the wrong judge to apply to, took the papers and reserved his decision.

The Incandescent Lamp Trade Combination.

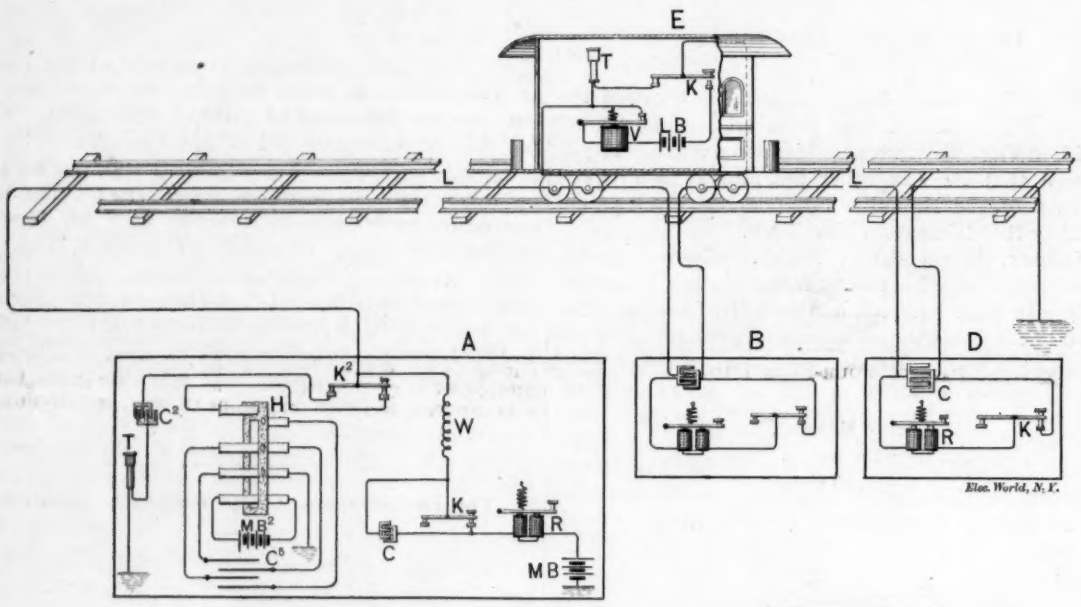
With respect to the agitation in regard to incandescent lamp "monopoly" in England, we take the following from the London *Electrical Review*: "The latest information on this eventful topic is that the Edison-Swan Company is inclined to consider any proposal the trade may choose to make with respect to manufacturing incandescent lamps under a royalty. If such a course be amicably arranged it will perhaps be the best for everybody concerned, for although the company will then virtually hold the monopoly of lamp patents, a proposition to pay a reasonable royalty will not be unacceptable to the trade, and in the event of a rupture in these proceedings, the Edison-Swan Company would then certainly insist upon its rights, as given to it by the result of the recent trial, the probability being that the different members of the trade would then be dealt with one at a time, as was the case in the telephone law suits. On the other hand, should the Edison-Swan Company prove unreasonable, a combined defense would have a much better chance of effectually succeeding, and even should success at first not be obtained on the present litigation, the company would have to consider the advisability of provoking the collective hostility, backed by the means, of the whole trade. Moderation on both sides may overcome a great difficulty, but to enable the trade and all interested in the incandescent lamp question to better consider the question of fair and reasonable terms, a meeting is convened for Monday, Nov. 8, at the Cannon Street Hotel, at three o'clock, at which it is hoped that the whole of those interested in the electric light industry will be represented. The meeting will probably be under the presidency of some well-known gentleman, who, without being immediately connected with any one system, may be generally desirous of the welfare of the electrical community. We would suggest that Lord Bury should be invited to occupy the position. Messrs. Woodhouse & Rawson propose to put themselves in the hands of the trade so far as settling their action with the Edison-Swan Company or the continuation of the litigation is concerned, and will abide by the decision of the meeting, provided that the cost of appeal, if made, is previously guaranteed. The expense will, we understand, not exceed the sum of £2,500. As representing the electrical trades in this country, we have been asked to act as treasurers to the fund, should it become necessary to call for such."

Duplex Railway Telegraph.

The system of telegraphing to and from moving trains invented by Mr. Lucius J. Phelps, of this city, has already been described in our columns, which recently also contained a notice that the system was now being installed on the Lehigh Valley Railroad, 100 miles of which was being so equipped. What lends additional interest to the undertaking, however, is the fact that the line has been duplexed, so that while employed in telegraphing to moving trains, it will also be able to carry regular business on the ordinary Morse system.

Before entering into a description of the method employed it may be well to recall briefly the manner in which signals are obtained on the car. It will be remembered that parallel with the track there runs a conductor into which vibratory currents are sent when the key is depressed at the station. A coil upon the car has currents induced in it which are made audible by a telephone in circuit or are converted into regular Morse "clicks" by the interposition of a delicate relay and local sounder. The duplex system is so arranged that the impulses sent over the line by the ordinary Morse currents do not affect the instruments on the car, and *vice versa*, that the vibratory currents do not affect the Morse relays.

The manner in which this is accomplished is shown in the accompanying diagram below. Here and *B* and *D* are two stations having the usual Morse transmitting and receiving apparatus connected to the line in the ordinary way. On the car *E* is placed the telephone *T*, battery *L B*, the key *K*, and a vibrator *V*, for throwing the current of the generator into vibration on the car circuit. The vibrations are controlled by the key in an obvious manner, and on circulating on the car cricuit are inductively transferred to the line and received on a telephone *T*, located at the station *A*.



PHELPS DUPLEX RAILWAY TELEGRAPH.

At the stations *B D* the Morse apparatus is shown consisting of the ordinary transmitter *K* and receiver *R*. This apparatus is shunted by the condenser *C*, which serves to provide a circuit for the vibration signals on the line when the line is broken through the contacts of the transmitter *K*. The condenser *C* also serves the purposes of preventing disturbance in the telephone through the sudden changes of tension on the line-circuit *L*, produced by the operation of the key at the stations *B D*. Its action in this respect may be termed a "graduating" action, inasmuch as it serves to gradually lower the tension on the circuit when the key *K* is opened, and to permit the tension to rise gradually when the key is closed. By this means the sudden changes of tension necessary to the production of induced currents on the vehicle-circuit sufficient in their tension to be heard in the receiver are prevented.

At the station *A* a main battery *M B* is shown, which constitutes the battery for the continuous line-circuit *L* and the telegraph apparatus there. The key which controls the vibration-signals sent from station *A* to the vehicle is shown at K^2. From the back contact of this key connection is made to ground through the condenser C^2 and a receiver *T* for vibration-signals sent from the car. The receiver consists of an ordinary speaking-telephone receiver *T*.

The key K^2, when operated, closes the contact connected with the generator of the vibration-signals. In order to prevent the diversion of the electrical vibrations thus placed on the line, a resistance *W* is interposed between the normal earth-connection of the line *L* and the point of attachment of the branch leading to the key K^2.

The apparatus for developing the vibration currents controlled by key K^2 consists of a battery $M\ B^2$, a condenser C^5 charged by current from the battery and a commutator *H*, which serves to alternately and rapidly connect the condenser first to the battery $M\ B^2$, to receive a charge and then to the connections leading to the transmitter, to be discharged over the line *L* in case the connection to line be closed by the key.

The commutator *H* which is of the well-known type, is so constructed that the condenser C^5 is charged in multiple arc by the battery $M\ B^2$ and discharged in series through the key and over the line in case the key be closed. By operating the commutator with sufficient rapidity a series of pulsations will flow to line during each closure of the key and will give the sensation of a musical tone on the receiver of the car, being taken up from the line by induction through the apparatus carried thereon.

The operation of the system will now be readily understood. With this arrangement the condenser and commutator are disconnected from circuit at the contacts of the key K^2, while the telephone-receiver *T* at the station *A* is in a branch connection from the line through the back contact of the key. The apparatus at the stations *B D* may be employed at any time in transmitting messages over the circuit formed from ground at the distant point over the line through the resistance *W* and battery *M B* to ground at the station *A*. When the line-circuit is closed through the telegraph apparatus at the stations *B* and *D*, the vibration signals placed on the line either by the operation of the key K^2 or by induction from the vehicle circuit flow in the ordinary manner. If the circuit be open at any station *B* or *D* through the opening of a transmitter *K*, the condenser *C* at that station preserves the circuit of the vibration signals. When the key K^2 at station *A* is against its back stop, the condenser C^2 in the branch prevents the battery-current from *M B* from short-circuiting to ground, while if the key K^2 be closed the condenser C^5 cuts off the current in the same manner. In the operation of transmitting messages from station *A* to the train the key K^2 is used in the ordinary way, and serves at each depression to introduce upon the line *L* a series of pulsations corresponding in the rapidity with which the condenser C^5 at station *A* is charged and discharged. These pulsations or vibrations are prevented from short-circuiting to earth at the station *A* by means of the resistance *W*.

Long-Distance Telephony.

In a pamphlet just issued by the American Telephone and Telegraph Company, some interesting facts are given bearing on the practical development of long-distance telephony, and we make below a few extracts therefrom :

"Since the first announcement of the invention of the telephone in 1876, nothing has been anticipated with more interest by the general public than its possibilities as a far speaker and a means of quick, certain and perfect communication between distant points. In the adaptation of the telephone to public uses, however, many obstacles were met with in attempts to communicate between points upward of fifty miles distant. On the grounded circuits then used, constant trouble was experienced from earth currents and other sources in sputtering and roaring sounds, while the inductive effects from adjacent wires made conversation difficult and at times almost impossible. Many attempts have been made to establish long lines, but the service has generally been attended by so many imperfections as to make it far from satisfactory.

"In the preliminary investigations, the most essential requirements were found to be : First, a most perfect conductor ; second, an increased volume of telephonic current, and third, an absolute relief from extraneous causes of disturbance.

"After repeated trials by the leading manufacturers of wire, a superior conductor for aërial lines was found in a hard drawn copper wire of great tensile strength and high conductivity. This wire, after being submitted to the severest tests, has proven to be the best ever produced for electrical purposes."

It is then pointed out that it is not in the receiver that improvement has been found necessary, but rather in the transmitter.

"Investigations were made in every direction and many forms of experimental apparatus were produced, until, as a result of the labors of Blake, Edison, Berliner, Gilliland, Hughes, Hunnings and others, the long-distance transmitter was perfected and is now ready for use.

"In the solution of the problem of preventing 'cross-talk' and induction between adjacent wires, greater difficulties were experienced. On account of noisy wires and the unsatisfactory effects common to the earlier lines, the local telephone companies were much discouraged, and the great expense of further experiment limited their extensions. The enterprise of the American Bell Telephone Company, however, was equal to the task, and in 1884, at great expense, a test line was built and equipped, extending from Boston to New York. For more than a year this line was operated in all possible ways, and in every form of connection, until it was fully demonstrated that, by the use of two wires in metallic circuit, protected from ground connections, all inductive and disturbing influences were eliminated and a perfect telephonic circuit established.

"Over the New York and Boston line, measuring nearly three hundred miles, conversation was carried on with the greatest ease, and even whispers could be distinctly heard. Thus the possibility of a perfect long-distance service was established.

"The requirements, however, were most exacting, demanding lines superior to any former extensions of telegraph or telephone companies, cables of great size and high insulation, and the most expert and careful attention in all details of construction and maintenance.

"The improved telephone apparatus is now offered for public use, and the telephone exchanges in New York, Brooklyn and the adjacent cities are now being equipped for metallic circuit service in connection with the lines of the American Telephone and Telegraph Company.

"By means of these terminal connecting lines, Philadelphia business men can, from their own offices, be placed in immediate and direct speaking communication with any of the subscribers to the telephone exchanges in New York and the surrounding cities and villages in New York, New Jersey and Connecticut, numbering in all over fifteen thousand stations.

"A very heavy line is now in process of construction from New York to New Haven, Providence, Boston and other New England cities. Many points in Connecticut, as far east as New Haven, are already in daily communication with New York, and additional connections will be made as rapidly as the lines can be extended."

Mr. Gould on the Western Union Policy.

It may appear to many people that the affairs of the Western Union Company are not in the very best shape, but Mr. Jay Gould, if he is to be judged by his reported talk, does not agree with them. The following is part of an interview had with him last week by a Boston *Globe* representative :

"In view of the present condition of Western Union would not a few words from you prove of interest to the public at large ?"

"I have nothing new to say on that subject that has not already been published. In brief, I can simply repeat that the more I see of Western Union the more I am impressed with the value of the property. It extends all over the country, in fact goes everywhere, and its facilities are capable of doing everything required of it."

"But, isn't the feeling quite strong against stopping dividends ?"

"On that score, I believe that the public approves of our course in suspending dividends and putting the plant in condition to maintain low rates. It shows its approval in raising the price of the stock."

"There are rumors on the street to the effect that the present advance in Western Union is simply for the purpose of unloading."

"Hardly ! I have not sold a share and have none to sell, because I would rather have it than most railroad stocks. The position of the company is less assailable than that of a railroad corporation."

"What is being done to strengthen the value of the plant ?"

"Principally in the way of putting up copper wires in place of those now in use, and in improving and strengthening the system in a dozen different ways, so we can do a great volume of business at a low rate and handle it better than any competing line."

"You are a believer in low rates, I hear, Mr. Gould ?"

"I notice in the papers that some of the stockholders of the French company want the cable rate advanced to twenty-five cents. It won't be done if the Western Union can prevent it. I believe that rates are down to stay, and that the patronage can be increased and the facilities improved to a point where the business will be as profitable at the present rates as at the old prices. On one point I am very positive, and that is that a year from to-day our income from the cable business will be as large as it was before the reduction was made. We are getting our facilities into shape to meet any rush that may occur, and I feel certain that the public will not pay two rates for an article when it can be had for one price."

"Is there any change in the telegraph war ?"

"There is nothing new. The status of the competition is unchanged."

Electric Headlights for Locomotives.*

BY OSCAR TYLER.

The writer proposes, briefly, to relate his personal experience with apparatus on the Lake Shore & Michigan Southern Railway between Cleveland and Erie, as engineer of engine No. 411, thinking that a short recital would be of interest.

Nearly three months ago an electric headlight apparatus was brought from Akron, Ohio, the invention of Mr. H. L. Pyle, of the Pyle Electric Company, of that city. It was placed on engine No. 411, and, although experimental only, it is an assured success, having never lost a trip. The train, No. 2 from Cleveland at 10 P. M., in its nightly run, is always a very heavy and rapid one, and the work of the engine, laboring heavily under high speed, has been a most rigorous test for the apparatus. The latter consists of a dynamo coupled direct to a high speed three-cylinder Gardner automatic engine, built by Dunbar & Co., of Buffalo, N. Y., and developing one horse-power. To it is connected by heavily insulated wires the arc lamp in the case.

The lamp, which may be considered the special feature of the apparatus, is of very simple construction, and is of such a nature that the time and duration of feed and the consumption of carbon are governed by a fixed mechanism, automatic and positive in its action. The effect of the light is something that must be seen to be appreciated. If you can imagine the result of placing a sun in the head case and throwing a beam of light down the track as far as the eye can see, you can possibly get some idea of the effect. Switch-lights, signals and targets, with both day and night colors, can be plainly discerned, and with favorable conditions 45 telegraph poles have been counted, the distance being considerably over a mile. The reflected rays of light heat the glass to such a temperature that it is kept free at all times from sleet and snow in winter blizzards, an advantage that can only be appreciated by the locomotive engineer.

The inventor is about to introduce a simple device for deflecting the shaft of light sufficiently to project it across the arc of the circle described by curves, thus completing a system that will reduce the chances of accident in night running to a minimum, and form a perfect safeguard.

The steam to operate the plant is not appreciable, and the innovation, for such it is, bids fair to work its way among the foremost inventions of the age applied to railroading.

The Resignation of Subway Commissioner Flower.

At the meeting of the Subway Commission held last week, the announcement was made that Mr. Roswell P. Flower had resigned his office as President of the body and had sent in his resignation to Governor Hill. The following is the document:

To Hon. David B. Hill, Executive Chamber, Albany, N. Y.:

DEAR SIR: Nearly six months ago you did me the honor to appoint me a member of the Board of Commissioners of Electrical Subways for this city. The board was at that time disorganized by the long illness and death of its President; it had reached no conclusion in regard to the novel and difficult problem it had to solve; its authority was questioned, and its powers made light of by the great corporations operating electrical conductors; it was besieged by the holders of alleged patent rights to devices for underground electrical accommodation, each of whom was positive that no other device than his own had the slightest practical value, and threatened by grantees of franchises for the building of conduits which had never been acted on, and its work was made more difficult of accomplishment by the insinuations and accusations which, through the misrepresentations of disappointed speculators, daily found their way into the press of the city.

At that time and under those circumstances I conceived it to be my duty not to refuse to do the work which came to my hand, but that I was bound, as a citizen anxious for the well-being of New York and for the carrying out of the laws of the State, to accept the responsibility you tendered me, even though I did so—as was the case—at great personal inconvenience and with disinclination.

To-day the problem has been solved. A general plan has been sketched out and a responsible organization has been found ready to pledge itself under heavy penalties to carry it into effect. Every precaution has been taken to guard for all time to come the interests of the city and of the electrical companies. Two miles of conduit, with accommodations for 1,500 miles of wire, are almost completed. One mile of wire belonging to the most important service in the city—the Fire Department—is successfully working within the subway.

It has been substantially demonstrated that no great electrical difficulty is involved in the burial of the wires, but that the only question to be settled is as to the relative merits of different conduits looked at as mere protecting coverings to afford security from pernicious underground surroundings and convenience in handling and distributing the conductors of the electric energy; and thus the conflicting and fallacious claims of those who so long attempted to befool the board have been set at rest.

Repeated decisions of competent courts have firmly established the constitutionality of the law under which the Commission is organized, and have done away with the pretensions of those who had it in their power to promote the building of subways, but who refused to do so until it seemed that the end would be attained without them.

I am convinced that you will have no difficulty in selecting a Commissioner more desirous and deserving of the office than myself, who, in connection with these who have served upon the board from its organization, and with the capable and energetic assistants we have drawn about us, will be able to carry to a successful termination the undertaking devolved upon the board by law. My private affairs demand more of my attention than I have for some time been able to give them. I therefore respectfully resign the office with which you intrusted me, and again thanking you for your consideration, remain your obedient servant, ROSWELL P. FLOWER.

As we go to press, the announcement is made that Mr. Gibbens, the counsel of the Commission, has been appointed Mr. Flower's successor by the Governor.

A New Four-Pole Elwell-Parker Dynamo.

The accompanying illustrations, Figs. 1, 2 and 3, taken

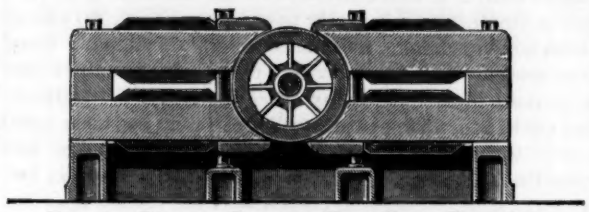


FIG. 1.—ELWELL-PARKER FOUR-POLE DYNAMO.

from *Industries*, represent a section, elevation and plan of the latest form of the Elwell-Parker four-pole dynamo.

The arrangement of field magnets is somewhat similar

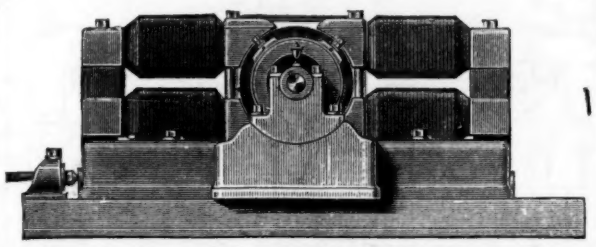


FIG. 2.—ELWELL-PARKER FOUR-POLE DYNAMO.

to that of the machine shown by Messrs. Elwell-Parker at last year's Inventions Exhibition; but the magnet limbs, instead of being inclined, are placed parallel to each other,

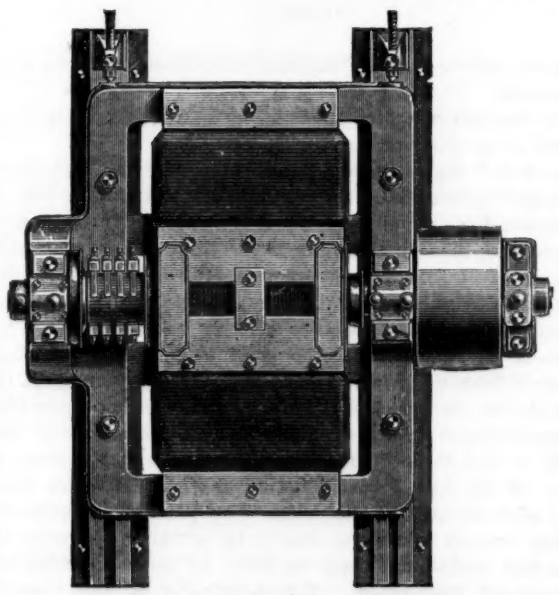


FIG. 3.—ELWELL-PARKER FOUR-POLE DYNAMO.

and are generally made of larger cross-section, whereby the output of this machine has been considerably increased.

The machine is shunt-wound, and is arranged to run at 450 revolutions per minute. The external E. M. F. is 130 volts, and the normal output of current is 385 ampères. The armature is wound with a single layer of silk-covered copper wire in 196 turns, and has a resistance of .015 ohms. To collect the current, a system of four sets of brushes is employed, opposite brushes being at the same potential. The magnets are compound-wound, and have a resistance of 15 ohms. If, on the basis of these figures, we calculate the electrical efficiency, we find that 93.5 per cent. of the internal electrical energy is converted into useful external electrical work. The machine measures in the direction of the spindle 6 ft. 4 in., and in the direction of the magnets 5 ft. 5 in., exclusive of its sliding bed, while its total height is 2 ft. 4 in. The total weight is 4 tons, being at the rate of 1.2 cwt. per h. p. developed in the external circuit.

A new two-pole dynamo constructed by the same firm gives 100 volts and 200 ampères at 950 revolutions per minute. The armature is wound with 104 turns of silk-covered copper wire, and has a resistance of .021 ohms, while the resistance of the shunt is 55.9 ohms. From these data it follows that the current in the shunt is 1.8 ampères, making the total armature current 201.8 ampères, which corresponds to a loss of 4.25 volts and 855 watts. The loss in the shunt is 182 watts, while that in the main coils is 200 watts, bringing up the total losses inside the machine to 1,237 watts. This, compared with the output of 20,000 watts, gives an electrical efficiency of 94 per cent.

A Reminiscence of the Gomez Electric Fuse.

We have received a bundle of papers, says the Boston *Transcript*, bearing upon the claim of Edwin Gomez, the inventor of the Gomez electric fuse train, to compensation for false imprisonment during the Rebellion. On the merits of the claim we prefer not to express any opinion, but the appended letter from General Butler to the claimant is too characteristic to be passed over. Following is the letter:

16 PEMBERTON SQUARE, BOSTON, March 22, 1886.

DEAR SIR: I have received your circular with this inquiry, "Can you do anything for me in this matter?" I can not. Your claim would be before Congress, and I never advocate private claims before Congress.

I take leave to say, however, that your fuse, to my certain knowledge, was a very excellent thing; and would to God that *the cowardly naval officers* had used it as they were directed to do on the powder boat at Fort Fisher, instead of leaving it hanging up in the cabin.

Yours truly, BENJAMIN F. BUTLER.

Edwin Gomez, Esq., Post-Office Box 127, Brooklyn, E. D., N. Y.

The italics in the above letter are our own. The charge of cowardice against the naval officers will ere long stir up such a reply as to make Butler feel as if a powder boat had been exploded in the near proximity of his law office. Apropos of the powder boat explosion, the following quotation from General Badeau is of interest:

At half-past ten on the night of the 23d [of December, 1864] the powder vessel started in toward the bar. She was towed by the gunboat Wilderness until the embrasures of Fort Fisher could be distinctly seen. The Wilderness then cast off and the Louisiana (the powder boat) proceeded under steam to a point within three hundred yards of the beach and about five hundred from the fort. Commander Rhind, the officer in charge, was better able to accomplish his task, as a blockade runner had gone on before him, and the forts made signals both to the blockade runner and the Louisiana. The night was perfectly clear, and it was therefore necessary to anchor the Louisiana. The fires were hauled as well as possible, the fuses lighted and the hulk of the vessel set on fire. Then taking to their boats the gallant party made their escape to the Wilderness, lying close at hand. That vessel at once put off to avoid the effects of the explosion. * * * No damage of any description was done to the rebel works or forces, and the experiment was an absolute failure.

So far as we are aware, General Butler is the only man who has ever accused of cowardice sailors who took a vessel loaded with powder and combustibles in under the guns of an enemy's fort and then set her on fire. And it seems to be an after-thought—very long after—even with him.

A Voltameter Voltmeter.

A voltmeter based upon the electrolysis of water has recently been devised. Two glass tubes, each say 16 millimetres diameter and 50 centimetres in length, are held by brass clamps which are attached to a wooden rod. Tube *A* is closed at the upper end by a stopcock, or a short piece of vulcanite tubing which can be squeezed tight by a screw-clamp will serve equally well. The lower end is closed by a well-fitting cork, which projects, say an inch beyond the tube. Through this cork passes a pair of platinized (or carbon) electrodes. The cork has also a wide hole bored first half way through from the upper side and then outward horizontally, so as to form a lateral communication with the tube itself. A short piece of glass tubing is fixed in the lateral opening, and over this passes one end of an india rubber tube, say 2 ft. in length, the other end of which is slipped over the lower end of tube *B*. This last tube is open at both ends. The stop-cock on *A* being open, acidified water is poured into *B* until its level stands about midway in each tube. Tube *A* being provided with a scale graduated in centimetres, the apparatus is complete. The method of use is as follows: The stop-cock remaining open, tube *B* is raised by sliding the clamp up the rod until the level of the water reaches nearly to the top of the scale on *A*. The stop-cock is now closed, and the electrodes are connected to the points whose difference of potential is required. After the current has been passing for a few minutes—the time being carefully noted—the height of *B* is again adjusted until the liquids are at the same level in the two tubes. We can then find from the scale reading the number of cubic centimetres of liberated gas at atmospheric pressure. If care is taken always to use diluted acid of the same strength, the resistance between the electrodes can be determined once for all.

Bleaching Paper Pulp.—A French inventor proposes to use electricity for bleaching paper pulp in the following manner. A solution of chloride of magnesium is used. This is of the strength of about 16 deg. Beaumé. On passing a current through, electrolysis taking place, various chemical reactions occur, setting free divers oxychlorides, which, so it is said, effectively bleach the fibre.

* Abstract of a paper prepared for the Annual Convention of the Brotherhood of Locomotive Engineers, held at New York, Oct. 22, 1886.

The Lighting Competition at Bay City, Mich.

For the last four years Bay City, Mich., has been lighted by electricity on a rental contract with the Swift Company, using the Brush system. The question arose lately as to the desirability of continuing on that basis or of purchasing a plant outright, to be operated by the city. As a result of the agitation on this subject, the mayor, comptroller and the whole city council visited several Western cities, to examine into the merits of various lighting systems and to gather information as to municipal ownership of electric light plants. Under these circumstances a very hot and bitter competition took place among leading companies to obtain the order for the apparatus that the city would have to purchase. Three reports were made by three different committees of civic authorities, covering a multiplicity of details, and all were strongly in favor of the system of the Indianapolis Jenney Electric Company, which had submitted a bid of $30,000 on a proposed plant of 120 arc lights with towers and mast arms. It is noticeable that the award was not made because the apparatus was cheap, as the bid referred to was the highest by about $1,300. The reports were adopted by the City Council and the contract was finally awarded to the company by a vote of 18 to 1.

Test of an Edison Central Station Plant.

The Edison central station at Oskaloosa, Iowa, which was put in operation Aug. 1 with 1,000 lamps, has succeeded so well that 1,500 lamps are now in circuit, and an enlargement of capacity is under way. The plant is located beyond the city limits, at a distance of about a mile from the centre of lighting, and cheap slack coal is burned under the boilers. On account of the distance of the station from the centre of distribution a loss of 23 per cent. is experienced in the conductors.

There are two slide-valve engines of 250 horse-power each in the station. They were built by the Iowa Iron Works, Dubuque, Iowa, and are provided with Gardner governors, which show a variation in speed of only 3.4 per cent. between maximum and no load.

A recent test gave the following results :

I. H. P. of engine, with load of 627 ampères and 130 volts	135.6	H.P.
Ampères per I. H. P.	4.62	"
" " H. P. delivered at armature	5.69	"
Lamps per I. H. P. (100 volts), including 23 per cent. loss in conductors	6.25	"
Lamps per I. H. P., 5 per cent. loss in conductors	7.5	"
Lamps (100 volts) per H. P. delivered at armature	7.70	"
Ampères	6.27	"
Volts at brushes	1.30	"
Watts at brushes	81,510	"
Watts per I. H. P.	601.1	"
Percentage of I. H. P. delivered to circuit as electrical energy, $\frac{201}{746}$	80.5 per cent.	
Assuming 90 per cent. electrical efficiency, this would give a percentage of I. H. P. delivered to dynamo by belt	90 per cent.	
Percentage of I. H. P. actually recovered as electrical energy in the lamps after loss of 23 per cent. in conductors	62.5 per cent.	

Considering the circumstances, the recovery of 80.5 per cent. of the indicated H. P. as electrical energy is very good.

A Train Stopped by a Mouse.

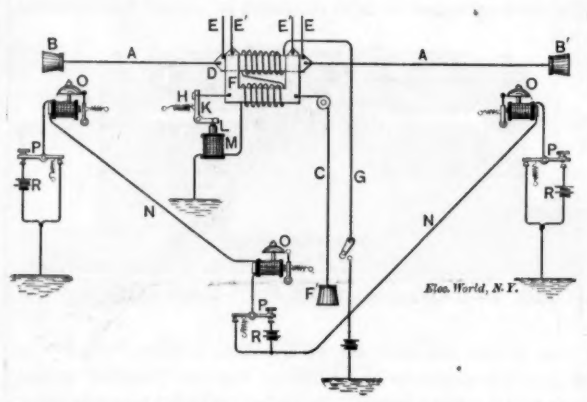
Did any one ever imagine, says an exchange, that a mouse could stop a railway train? It seems to be impossible; nevertheless it was done recently at the town of Capri, near Modena, in Italy. On the Italian railroads an electrical apparatus, upon the departure of a train from any station, rings six strokes upon a gong in the next station. The station-master at Capri, hearing his gong ring three strokes where there should be six, immediately came to the conclusion that there was something wrong on the line and ordered up the electric signals of warning. The train, which by this time was under full headway, came to a dead stop. Then began a transfer of telegraphic messages. The passengers were anxious to know what was the matter. They waited while the messages went back and forth. The inquiry established the fact that every thing was right on the line, and the train was ordered forward after considerable delay. The station master, about this time, thought it might be well to look into his gong, and there he found, stuck fast between the cogs of the electrical apparatus, a poor little mouse. The unhappy animal had happened to be in the interior of the clock when it "struck one," and down he attempted to run, but was caught between the murderous wheels. His little body was big enough to stop the whole apparatus, and consequently the train as well.

An Interesting Night for an Operator.

The following story of an operator's peril is told in a special dispatch from Pittsburgh, of Nov. 4 : Peter Kennay, employed as telegraph operator at Ingram Station, on the Pittsburgh, Cincinnati & St. Louis Railroad, had an adventure at an early hour this morning that he will not soon forget. He was engaged at his instrument about 1 o'clock this morning when he heard a noise as of some one trying to open the door, but thought nothing of it, nor even looked up from his work until startled by a touch on his coatsleeve. He turned partly around, and saw a tall, gaunt figure, dressed in white, with a long knife in its hand, standing directly over him. He cleared the railing surrounding his desk at a single bound, but the strange visitor was between him and the door and he began pleading for his life. The spectre made no move to follow him except to prevent his escape by the door. As the ghostly creature made no advance the operator in a measure recovered his self possession and stood on the defensive in the furthest corner of the room. The apparition then seated itself in Kennay's chair before the telegraph instrument, keeping a close watch on the movements of the operator. They maintained the same relative positions for nearly an hour, during which time trains on the railroad approaching that point were brought to a standstill. One or two trains had been stopped for the signal to go ahead. The crew of the first train finally walked up the track to the telegraph office to find out the cause of the delay, when it discovered the operator's predicament and subdued his captor after a desperate struggle. It was subsequently learned that the strange visitor resided at Sheridan Station, nearly a mile away, and had escaped from his home about midnight.

Farmer's "Village" System of Mechanical Telephony.

In localities where a small number of subscribers are situated within a short distance of one another, as in villages or small towns, it rarely pays to have a central office or telephone exchange, and hence several "village" telephone systems have been devised, by which one subscriber can connect himself with any other without the medium of an exchange. Thus far the village system has been confined to the electric telephone in its application, but recently Prof. Moses G. Farmer has devised a method by which the lines connecting mechanical telephones may be joined together so that communication may be had between one station and others at the will of the caller. While electricity is employed in this method, it enters only into service as an adjunct to connect the lines mechanically.



FARMER'S "VILLAGE" SYSTEM OF MECHANICAL TELEPHONY.

The manner in which the method is carried out is shown in the accompanying diagram.

Here *AA* represent a mechanical telephone line, with terminal instruments *B B'*; and only one branch line *C* is shown for the purpose of illustration. At the point where this branch is to meet the main line a flat and comparatively light strip of soft iron *D* is inserted directly in the main line and forms a part thereof, the wire *A* being severed at that point and its ends connected to those of the strip *D*. The latter is suspended by rubber bands *E* from a stationary support. The introduction of this device in the line has no sensible effect upon the transmission of speech over the line. On one side of the strip *D* and close thereto is suspended a flat U-shaped piece of soft iron *F* by the bands or cords *E'*, which connect with the ends of the piece. The piece *F'* is included in the branch telephone line *C* by severing the wire of that line and connecting its ends to opposite sides or corners of the piece. The terminals of the branch line are connected each to a telephone, or one to a telephone, as *F'*, and the other to a spring support, described below.

Normally there is no connection between the two iron pieces *D* and *F*, and the telephone *F'* is in no wise affected by the operation of the line *A*. To bring the telephone *F'* and its branch circuit in connection with the main line so that conversation may be carried on between either *B* or *B'* and *F'*, or between *F'* and any other branches, the two pieces of iron *D* and *F* are wound with insulated wire, making them, respectively, an armature and magnet; but these coils are so made that they do not touch the pieces *D F*, but permit them to move freely within the coils. An electric circuit *G* is run from a point near the instrument *F'*, and grounded through the coils on the magnet and armature. By closing this circuit the magnet and armature, being energized, are brought in contact, and adhere to one another so long as the circuit *G* remains closed. Under such conditions the vibrations produced in one line will be imparted to the other, and the instrument *F'* is thus brought in connection with either of the main-line instruments, or with any other branch instrument which may be at any time connected with the main in a similar manner.

Professor Farmer prefers to use only one instrument for each branch line, as shown, and to connect the other end to a spring in order to maintain a tension on the line. Thus, as will be seen, the spring *H* is connected at one end to a fixed support, and at the other to a pivoted bell-crank lever *K*. The end of line *C* is connected to the same end or arm of this lever as the spring, so that normally the full effect of the spring is exerted in maintaining the line under tension. The other end of the bell-crank lever *K* carries the core *L* of a solenoid *M*, which is included in the circuit *G*. When the circuit *G* is closed, the solenoid stretches the spring *H* and relaxes the tension of the line to a certain extent. Under the action of the spring alone, the line *C* is so taut as to hold the magnet *F* away from its armature ; but by relaxing this tension somewhat the contact of the two is made easier.

With this system Professor Farmer employs an electric circuit with call-bells. This circuit *N* is represented as running to each telephone, at which it includes a bell. There are also provided keys or switches *P*, with back contacts that ground the line at its terminals and batteries *R*, one with each switch, so that any subscriber can call up any of the others. An ordinary call or signal system may be used for this purpose.

"The Telegraph in America."

In the earlier part of the present year we published two illustrated reviews of the second edition of the above work, by Mr. James D. Reid. In the course of one of the notices, it was said: "Mr. Reid, as is well known, was an early associate and friend of Morse, was also the first telegraph superintendent in the world, and through all the many vicissitudes of his long and honorable life has been so closely identified with the advance of telegraphy here that it has been epitomized in his personal career. This in itself is a remarkable qualification for the office of historian, insuring an acquaintance with the men named and an intelligent apprehension of the significance of events. But to all his other merits, Mr. Reid adds the possession of an unusually direct, clear and graceful literary style, as well as an enviable delicacy of wit, and a commendable liberality of sentiment. Of course there are various matters in connection with a subject so overloaded with vexed questions as telegraphy, in regard to which Mr. Reid does not win an entire approval from everybody for his version of them ; but taken all in all, his book is one that will stand with growing credit to its author, as a brilliant yet trustworthy history of the early days of American telegraphy." Since the above was written, the book has met with a very cordial reception. But the work of being his own publisher, in addition to the discharge of his other duties, has proved too much for Mr. Reid's strength and leisure. An arrangement has therefore been entered into by which Mr. W. J. Johnston becomes the sole publisher of the book, relieving Mr. Reid of any further anxiety and responsibility in regard to it.

Owing to the popularity that the book has enjoyed, the edition of it is nearly sold, and it will soon, like the first, be out of print. As the plates have already been destroyed, no other edition can be issued. The opportunity to secure a copy is, therefore, one that should now be taken advantage of. The book, it may be said, is a very handsome production of not far short of 900 pages, large octavo. It contains twenty-four steel-plate portraits, nearly fifty other engravings in wood, of well-known telegraphers, and about 70 miscellaneous illustrations. Some idea of the money spent on the book can be gathered from the fact that some of the steel plate portraits cost over $200 each : and the illustrations, all told, cost more than $5,000.

We therefore call special attention to the announcement made in regard to the book, in our advertising pages, and would simply add that the typography and binding are remarkably good.

A New Coulomb-Meter.

M. Jacquemier has devised a coulomb-meter, says the London *Electrician*, based upon the following principles: An ampère-meter, which may be of any known construction so long as the deflections are proportionate throughout the scale, is connected with a train of clock-work. A wheel which makes one turn per minute carries a detent. At every revolution the latter closes with a second train of wheels, by means of which the index is moved upon the scale where the coulombs are read. The moment when the two trains gear together is that at which the detent upon the first wheel is passing zero point upon the scale of the ampère-meter ; the disengagement, upon the other hand, is effected when the detent arrives at the needle of the ampère-meter, wherever it may be upon the scale. Thus the distance traversed by the needle of the coulomb-meter at every revolution—that is, once every minute—is proportionate to the current indicated by the needle of the ampère-meter. If the ampère-meter is not constructed to give proportionate deviations, M. Jacquemier employs a suitable cam, mounted upon the same axle, to carry the detent. From the description it would seem that the method is not accurate when the current strength undergoes any rapid fluctuations.

On Distributing Electricity by Transformers.*

BY CHARLES ZIPERNOWSKY.

After a brief reference to the several attempts that have been made to overcome the difficulties in the way of lighting a considerable area by means of electricity since the subdivision of the electric light has become an accomplished fact, the author points out that a practical system of distributing electric energy over a large area can only be based upon the use of high tension currents for conveying the energy from the generating centres, in combination with some mode of reducing the high tension to the limits of difference of potential which can be made use of without danger or difficulty. This limit is at present about 100 volts. Many methods have been suggested for meeting these conditions.

Thus a counter electromotive force can be introduced into the high tension circuit, as in the case of accumulators, and the terminals of such a device connected with the lamps, etc. The cost is, however, a great defect of the system, and the high tension current which exists at each lamp might lead to fatal consequences.

After referring to the electric transmission of power as another means of overcoming the difficulty, the author discusses the use of induction coils or "transformers" in some detail, tracing their use in the first instance to C. W. Harrison in 1857. Among subsequent workers Jablochkoff, C. T. Bright, Fuller, Varley, Haitzma Enuma, Gaulard and Gibbs are mentioned; and he argues that the want of success was in great part due to the fact that the transformers were connected up in series, an arrangement which is only suitable for use with an invariable number of lamps in any one secondary circuit, or when each transformer supplies only one lamp.

Besides considerations in regard to cost, the conditions to be satisfied by a system of electric distribution are stated as follows:

(1). Perfect independence of the several consumption devices.

(2). Absolute and relative economy, so that the consumption of energy is in proportion to the number of lamps in use.

(3). All regulation to be concentrated at one central station.

The author then proceeds to describe the method he has devised in conjunction with M. Max Déri, and with the assistance of M. O. T. Bláthy, to satisfy the above conditions.

This is based on the fact that, with a constant primary tension, the secondary one will vary only in proportion to the internal resistances of the coils; and as the resistance of each coil is less than 1 per cent. of the external resistance, the secondary tension will not vary more than 2 per cent., whatever be the intensity of current supplied to the consuming device. Constancy in the primary tension at the transformer terminals is secured by connecting them in multiple arc with the main line, and the arrangements are such that current and tension are distributed in the primary circuits, much as in a low tension direct supply system, the transformers simply acting as tension-reducing devices.

Instead of the old Ruhmkorff coil pattern of transformer a form is adopted such that the lines of magnetic force circulate entirely in iron, or as nearly so as possible, by which arrangement a considerable economy of magnetizing force is effected and other advantages are at the same time gained. Two forms of transformer made on these principles are described, as well as the self-regulation of alternating current machines, which is especially valuable in installations of moderate size.

This system is at present in use in the towns of Gerona in Spain, Lucerne, in Milan, and stations are in course of erection in Turin and Rome. The arrangements for the last named are explained in detail and illustrated by a diagram, and the author concludes by claiming that, although the last word has not yet been spoken in relation to the distribution of electricity over large areas, the above system is the only one with which he is acquainted that approximates to the fulfillment of an ideal distribution.

* Paper taken as read before the British Association at Birmingham.

A New Train Signal System.

Various methods of signaling electrically from the cars of a train to the locomotive have been devised. The voltaic battery has, as a rule, been employed as the source of current, but, in order to avoid the inconvenience attending its use in such situations, Mr. Erwin S. Graver, of Philadelphia, has designed and recently patented a train signal system in which batteries are replaced by small dynamo-electric machines which require no attention.

Our illustration, Fig. 1, is a diagram view of the bell, situated in the cab of the locomotive, and the signaling apparatus situated in each car. The circuit is made by a wire run through each car continuously by means of couplings, the return being made through the wheels and tracks The apparatus situated in each car is shown in side view and in plan in Figs. 2 and 3. It will be seen to consist of a small dynamo *A*, to the armature shaft of which is fixed a ratchet wheel *B*. Pivoted on the shaft also is a lever *D* which carries a ratchet *E*, so that when the lever is turned in the direction of the arrow the armature is revolved. The lever is of brass, and after traversing a certain distance comes in contact with the spring *J J*, and closes the circuit which before that time is open. The spring *F* is provided for the purpose of bringing the lever back to its original position.

A cord passing the whole length of the car is attached to the end of the lever *D*, and from the description it will be readily understood, that by pulling the cord the lever is drawn over, the dynamo started and a current sent into the bell in the engineer's cab.

The object of providing the springs *J J* will be seen to be for the purpose of preventing a short circuit to the bell. For, if the circuit should be permanently closed in any car, the current generated would pass through this

FIG. 1.—A NEW TRAIN SIGNAL.

passage in preference to the bell, hence, leaving the latter without any indication that a bell cord had been pulled.

The connection employed to join the wires of adjacent cars is shown in Figs. 4 and 5; which require no further explanation. The generator can be placed in the toilet room and the rope run along the side of the car.

The Distribution of Electricity by Underground Conductors.

An ideal underground system for the distribution of electricity must secure, says the London *Electrical Review*

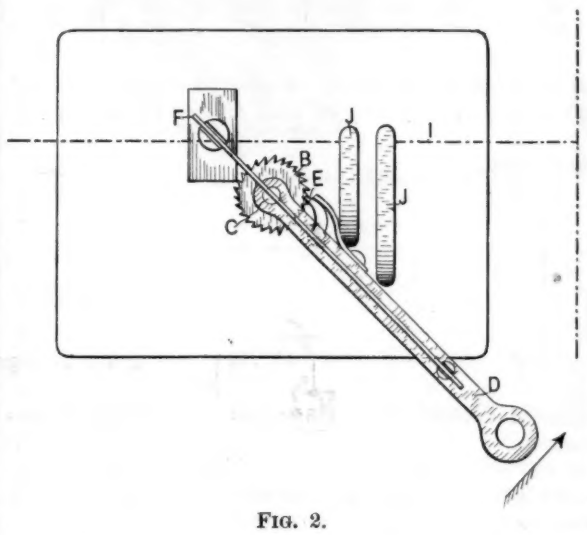


FIG. 2.

of Oct. 29, the adequate protection of the cables when laid, and provide easy and rapid means of repair; while it is desirable also that it shall be possible to make extensions and increase the number of conductors without fresh excavations being rendered necessary. The inventors of the Callender and Webber system, a working example of which is on exhibition at the works of the Anglo-Ameri-

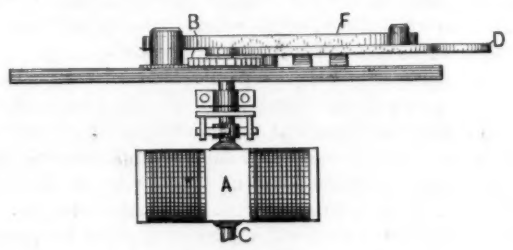
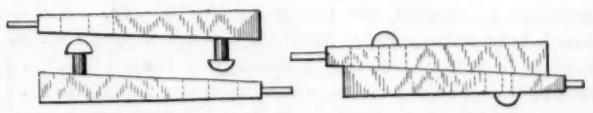


FIG. 3.

can Brush Electric Light Corporation, claim that they have fulfilled the requirements stated, and have introduced important advantages in other respects.

Theirs is a "drawing-in" system, its specialty consisting in the provision of a separate "way" for every cable, each way being a closed passage impervious to water or gas, completely separated from all other ways and earth by a



FIGS. 4 AND 5.

wall of material in itself a fair insulator. The danger of "earths" or "contacts" is thus reduced to a minimum, as it would be necessary to penetrate both the wall of the case and the dielectric of the cable before the insulation could be destroyed.

The cases are constructed of a bitumen concrete, possessing great strength, giving very high results when tested with respect to crushing, tensile and breaking strains, and in the composition of which only pure, natural bitumen is used. No coal tar, pitch or other product containing light volatile oils is employed, so that the cables are absolutely unaffected by the material of which the cases are composed. This concrete is said to be impervious to water, and s unaffected either by the gases or acids found in the soil. It does not expand or contract. It is strong, capable of sustaining heavy weights without injury, and is elastic, bending rather than breaking.

The cases are preferably rectangular in form, pierced with holes or ways of a diameter suitable for the cables to be drawn in. They are generally six feet in length, but are also made in lengths of from three to twelve feet. The joints are formed by paper tubes or by saddles closing round the cases cemented together by molten material, similar in composition to that of which the cases are made, the whole then forming one homogeneous mass.

Light shields are fitted in the ways and kept in position by mandrils to insure that no bitumen shall penetrate during the process of jointing, and that no rough edges present themselves at the joints to interfere with the drawing of the cable or injure it in its passage. Drawing-in boxes or man-holes of the usual type are provided wherever necessary, to give access to the cables for repairs or for providing additional leads.

Bitumen concrete exposed to every variation of climate, to cold and heat, wet and dry, is practically imperishable, and there is no doubt that these cases will last general tions. This material having practically no co-efficient for expansion, one of the greatest difficulties in actual work is non-existent, and joints once made between the cases are not liable to part or buckle up in cold or hot weather; it is also one of the best non-conductors of heat, and in respect of both these points it is immeasurably superior to iron.

The cost of laying is small, and jointing is not more expensive than for ordinary iron pipes, while a more effectual joint can be produced.

The ways are smooth and free from the cutting edges found in iron castings. There can be no rust, and, consequently, when cables have to be drawn in and out there is much less friction and less liability of injury to the insulation. Cables drawn into these ways remain loose, without adhering to the bitumen concrete, and by the exercise of a little care after they are first placed in position they will permanently retain this freedom of movement, so that a faulty section can be withdrawn and replaced easily at any time.

The bitumen concrete employed is made under the patent of J. W. Butler, and the system of laying is that patented by T. O. Callender and Major-General Webber, C.B., R.E.

Pictures Produced by Lightning Flashes.

Much interest was manifested a short while ago in a picture which was said to represent the features of a young lady, and which, it appeared after careful investigation, was due to the action of a stroke of lightning. Mr. Geo. W. Mansfield exhibited the brass plaque on which the picture was imprinted before the Electrical Section of the American Institute, where quite a lively discussion regarding its origin took place, at a recent meeting, Dr. Vander Weyde, among others, holding to the opinion that the picture had not been produced by lightning.

Dr. Vander Weyde investigated the subject further, and at the last meeting of the Section gave the results to the Society. He stated that various spirituous liquors poured upon a brass tray and allowed to dry would leave imprints upon the metal similar to those exhibited by the plaque shown before the Society.

He concluded by exhibiting two pieces of blotting paper cut into profiles, and which, when dipped in lemonade, produced their images upon a brass tray.

In reply, Mr. A. A. Knudson read a communication from Mr. T. C. Martin, in which the latter gentleman drew attention to the fact that this peculiar action of lightning had already been noted, quoting as an instance an article which appeared in *The Operator* for Jan. 1, 1876. The article reads as follows:

AN ELECTRICAL LIKENESS.

We learn that within the last two weeks a singular discovery has been made at the house of Jesse Garth, for many years deceased. It is said that a distinct and accurate likeness of Mrs. Garth, who has been dead for twenty years, can be seen on a pane of glass in the upper sash of one of the windows, presenting very much the appearance of a photograph negative. The discovery is said to have been made by a woman who was washing clothes in the yard, who imagined some one was watching her through the window, and went inside to see who it was. We gather these facts from Dr. Charles Brown, who has himself seen the singular picture. Dr. Brown remembers that about twenty years ago Mr. Garth told him that his wife, while standing at the window, was stunned by a sudden flash of lightning, and the doctor's theory is that the outline of her features were photographed on the window at the time. The youngest daughter of Mr. Garth, and others who were acquainted with Mrs. Garth, have seen the picture and pronounce it a striking likeness. It it said to be more distinct about nine o'clock in the morning and three in the evening than at any other time of the day.—*Charlotte (Va.) Chronicle.*

The Julien Electric Car.—It will be remembered that the Julien electric car, propelled by a motor deriving current from storage batteries, was awarded first prize in the competition at the Antwerp Exhibition. One of the cars, operated by M. Julien himself, is now at the Eighth avenue car stables, and has already made a number of successful runs. There can be no question as to the practicability of the system.

The Brussels Exhibition of Telephony.

The following circular has been issued relative to the exhibition of telephonic apparatus to be held in Brussels early in 1887, under the auspices of the Société Belge des Ingenieurs et des Industriels, with which the Belgian Society of Electricians has recently been amalgamated :

"This exhibition is intended to display all the apparatus and processes hitherto devised for the transmission of the human voice to a distance, and the application of these methods down to the latest date. Its character will be both scientific and practical. The exhibits will, therefore, comprise telephones, microphones, radiophones, and phonographs; switch-boards and other appliances connected with telephone exchanges; 'toll' stations; conductors and insulators, and all 'out-door' appliances. Further, special consideration will be given to anti-inductive systems, to the use of cables containing large numbers of lines, to long-distance telephony and apparatus connected therewith, and to systems of simultaneous telegraphy and telephony. In addition to actual apparatus, plans, diagrams, or models will be received. A series of experiments and of competitive trials will be undertaken and conferences will be held. No charge will be made for space. Applications must be sent in before 1st December. The Exhibition will remain open for five weeks. Any one desiring to contribute to the discussions, or to make any suggestion with regard to the experimental work, is requested to communicate with H. Aerts, the president of the committee of conferences and exhibits."

A special invitation is made to American exhibitors, as will be seen from the official announcement in our advertising columns, and we trust that the opportunity will be seized.

Unsuspected Dangers with Frictional Electricity in Blasting.

BY W. E. IRISH.

Some years ago when I was engaged in assisting to carry out a series of experiments in the firing of torpedoes and mines by means of electricity, an incident occurred which nearly resulted in a most serious calamity through the want of knowledge regarding the power of induction.

About a week after the commencement of a long series of experiments, several charges of gunpowder, gun-cotton and dynamite were submerged in a river about one hundred feet apart, the object being to learn what the effect of each would be when fired under the same conditions. The firing station and position of the charges in the river were on this occasion totally obscured from each other and about one mile apart. The cable employed to connect the charges with the firing apparatus consisted of a stranded copper conductor well insulated with "Hooper's compound." Two lines were used for firing the charges, and a third or special cable of the same description was laid for communicating between the two points by telegraph. The three cables were laid on the grassy land parallel to, but separated from, each other by a space of a few inches throughout the greater part of their length. Electricity for firing the charges was obtained from Baron Von Ebner's ebonite-disc frictional machine, which is too well known to need description.

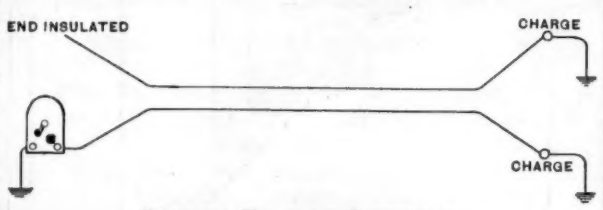
The two ends of the cables at the river were each connected to a charge, while at the firing station one end was carefully sealed and suspended in the centre of the firing room as a precaution and guard against the possibility of its coming in contact with the firing battery or machine. The other end was connected to the electric generator in connection with the charge to be fired first.

Final arrangements having been completed and all made ready, instructions were telegraphed to fire No. 1 charge, which was carefully and correctly done. Scarcely, however, had the firing key been depressed when word was wired from the river "to stop further operations, and leave everything at the firing station in the exact position it then occupied, as two charges had been fired instead of one only, as directed; and that in consequence a boat and party of men engaged near the charge which ought not to have been fired had most miraculously escaped being blown to pieces." This was declared by the operators at the firing station to be impossible through any action or neglect on their part. The matter, however, was too serious to be left without a thorough and searching investigation. There was no question as to the second charge having been fired, and a careful examination of the cables between the points, immediately after the occurrence, failed to show the slightest sign of their having been tampered with. The evidence tended to locate the cause at the firing station, but how or by what means the charge was fired was quite unaccountable to all, and remained a matter of conjecture for several days, as the spare end of the cable had remained securely sealed and suspended, and was at the time of firing many feet away from the electric generator. A very careful examination and insulation test of the end of this cable in the firing station proved that it had not been injured or tampered with in any way.

It was determined to unravel the mystery, if possible, and we set resolutely to work and were not long in discovering that under precisely the same conditions the same result was always obtained. One gentleman ascribed the cause to be the detonation of the charge fired, but we had satisfied ourselves from the outset that such was, under the circumstances, very unlikely indeed. Experiments and investigation led us eventually to discover the fact that the firing of the second charge was due to induction. This, at first, we found some difficulty in proving to the entire satisfaction of the gentleman who stood up so stoutly for the detonating theory. To remove all further doubt, and for the information of all concerned, two half miles of the same description of cable were placed one foot apart throughout their entire length, fuses being connected to the cables at one end to represent the charges, and the wire being then grounded as before as shown in the accompanying diagram. To one of the cables at the firing station the frictional machine was connected, while the other end was carefully sealed and suspended in the same room as before and at least ten feet away from the electric generator. The discs of the machine were given twenty revolutions and the condenser was discharged, when both fuses fired. Other tests were then made, as given in the following table, to discover the greatest distance through which this inductive action would fire a charge, the wires being arranged as described above.

Distance of cable apart in feet.	No. of revolutions of the disc.	No. of charges fired.	Distance of cable apart in feet.	No. of revolutions of the disc.	No. of charges fired.
6	20	2	20	30	2
3	4	2	30	30	2
3	4	1	40	30	1
9	20	2	40	30	1
12	20	2	40	40	1
15	10	1	40	50	1
15	20	1	40	50	1
15	30	2	35	50	1
20	30	2	30	50	2
25	30	2	30	50	2

It would be dangerous on cables running parallel and within forty or fifty feet of each other, to employ the



CHARGES FIRED BY INDUCTION.

frictional machine where more than one charge is connected.

It will be seen from the above table that a charge connected with a cable, one end of which was insulated, could be fired by the inductive action of another cable running parallel to and separated from it by a space of thirty feet when one class of electric generator was employed; whereas, with a different generator the second fuse was not fired, even when the cables were tied or twisted together, as will be shown by the following tests.

The frictional machine was now removed, and tests were made with dynamic machines and voltaic batteries, but in no instance did we succeed in firing more than the one charge, and then it was the one connected in circuit with the machine or battery, even when the wires were as close together as it was possible to get them.

These experiments clearly prove that the detonation from the primary charge fired was not the cause of the second one exploding, and that the action was alone due to induction. Had it been due to the detonation, both charges would have been fired as readily by a dynamic machine or voltaic battery as with the static machine.

The writer is well aware that one charge is frequently fired by the detonation of another when the two are within a limited distance of each other.

This power of induction could be put to good use, particularly in naval warfare, in firing and destroying the enemy's mines. It may also be interesting to know that, with a thirty-cell Grove battery and similar cable to the above, we succeeded in firing through a fault made by stripping off twenty-four inches of the insulation and submerging the bare wire in the sea. With an induction coil, we failed to fire through a fault in the insulation only sufficient to expose the conductor to the eye. Wheatstone's magneto-exploder fired the charge through a leak $\frac{1}{32}$ of an inch long, but failed through a fault exposing $\frac{1}{8}$ inch of the conductor. Siemens' dynamo machine fired the charge through a leak exposing a surface of $\frac{3}{10}$ inch, but failed to do so with a larger fault. Von Ebner's frictional machine fired through a leak of $4\frac{1}{2}$ inches of bare conductor. It also fired the charge through a perfect break in the conductor. A four-cell Grove battery fired through $\frac{3}{4}$ inch leak, but failed to do so through $\frac{7}{8}$ inch.

These rough and ready tests and experiments were made to show as simply and quickly as possible, to men having little electrical knowledge, the most suitable firing apparatus to use under certain circumstances and conditions.

I have not seen any published information relating to this subject, and as the facts as here stated do not appear to be generally known, I think them of sufficient interest to record, in order that accidents may be avoided by the use of such apparatus in the hands of the inexperienced.

Electrical Illumination of Lighthouses.*

BY J. HOPKINSON.

The employment of the electric arc as a source of light for lighthouses has received attention for many years, but no apology is needed for returning to the subject, as the rapid development of electric apparatus brought about by the use of the electric light for other purposes, and the perfecting of new forms of motive power continually introduce new aspects of the question. An elaborate experimental inquiry has recently been conducted by the Trinity House concerning the relative advantages of electricity, oil and gas as lighthouse illuminants, the actual experiments being addressed mainly to a comparison of the results obtainable in a practical shape by each illuminant in its maximum development, and it was conclusively proved that whether in thick weather or in clear the most powerful light at a distance and the most penetrating in fog could be exhibited from the electric arc. A further inference was drawn from a consideration of estimates of cost of the three systems, viz., that the electric light was necessarily costly, and could only be economical when enormous power was needed. The latter inference is no doubt valid so far as the particular electrical and mechanical appliances considered by the Trinity House Committee are concerned. The question may, however, be looked at from another point of view—given a limited permissible outlay and a limited annual charge for attendance and material, what can be done for the mariner by the aid of electricity?

Let us first see what are the intrinsic advantages of the electric arc. They all lie in great power in exceedingly small compass. The effect of the small size of the arc light upon the power of the light when used with optical apparatus has been often pointed out, and the accuracy with which positions of danger can be marked by colored sectors is also familiar to engineers. Less consideration has been given to the fact that it is undesirable to make the brightness of the light at any distance unnecessarily great, as the excessive brilliancy dazzles the eye. It is a desideratum, then, whilst directing as powerful a beam as possible to the distant sea, to avoid throwing more than a moderate illumination on the nearer sea. It is possible to realize this desideratum far more effectually with a small source of light like the electric arc than with any other illuminant; but with the exception of one lighthouse, so far as I know, it has been very partially attempted, the reason being a fear that the proper position of the arc could not be maintained. Almost the only complaint made by the mariner of existing electric lighthouses is that at a moderate distance they are dazzling. This is solely due to the fact that too much light is directed to the sea, or, which comes to the same thing for this purpose, the beam directed to the horizon has, in order to cover any possible error of position of the arc, too much divergence imparted to it. Owing to improvements in lamps and carbons, it is now safe to concentrate the light much more closely upon the horizon, with the double advantage of greater power where the light is wanted and moderated power where excessive power is injurious. This view is fully confirmed by the experience of the two most powerful lighthouses yet erected, otherwise than by way of experiments, Macquarie in New South Wales, and Tino in Italy, both constructed by Messrs. Chance Brothers & Co. The former is a first order optical apparatus, focal distance 92 cms., and although the concentration on the horizon is greater than in any previous lighthouse, complaints have been occasionally made that the light is too bright at short range.

Tino is a second order 70 cms. focus, and the principle of strictly limiting the divergence and giving a smaller proportion of the whole light to the nearer sea is carried much further. The result is that in clear weather the apparent brightness of the light as seen from the sea increases with the distance, till a distance of eight or ten miles is attained, when full power is reached. By means of the simple optical appliances provided there has never been any difficulty in keeping the source of light accurately at the focus. Experience, then, shows that a specially advantageous distribution of light between the nearer and more distant sea may be obtained with the electric light, provided a large and suitable optical apparatus is used.

Distinction of lights apart, the true measure of efficiency of a lighthouse may be said to be the fewness of the occasions at which it fails to be visible at its advertised distance, subject to the condition that at no distance shall its brightness be an annoyance. This is obtained by greater optical concentration towards the horizon, with limited illumination of the sea, together with the power of widely varying the intensity of the source of the light, conditions which can be better realized with the electric arc than with any other source. The electric light, possessing the advantages named, it is its supposed great cost which bars its introduction in many lighthouses.

Why, then, should the electric light be so excessively costly in a lighthouse for any but the very greatest powers, such as are only worth providing for a few important landfalls? The great cost both of first outlay and maintenance appears to arise almost entirely from the fact that the machinery is arranged to supply on each and every

*Paper read before the British Association at Birmingham.

night, however clear, an unnecessary amount of power; consequently the heavy machinery always used is remote from the lantern, and it is necessary that two men shall always be on duty, one in the lantern, and another with the machinery. Further, the dynamo machinery selected has been of a costly and cumbrous description. The essentials for a cheap electric lighthouse are that for ordinary states of the atmosphere there shall be provided a plant under the easy control of the light-keeper himself, and which shall be precisely adapted to produce that amount of light which is wanted in ordinary states of the atmosphere; but for thick weather there shall be provided a much more powerful engine and dynamo, available also as a reserve in case the smaller machinery from any cause breaks down. The occasional machinery may be more remote from the lantern, as it is a small matter to require a second man to work on the comparatively rare occasions when the maximum power is needed. A small gas engine and dynamo machine can be placed without any crowding in the room immediately below the lantern, and arrangements can be made whereby the light keeper, whether he is in the lantern or in the engine room, can ascertain at a glance whether the arc is in its proper position, with an error of less than one millimetre. The attendance on the lamp rotating apparatus of the lens (if a revolving light), engine and dynamo would be easy when the whole is brought together so as to be under observation at once; in fact, the gas engine and dynamo and lamp constitute together a gas burner which, though consisting of many parts, is automatic throughout, and when at work requires nothing but the constant presence of a custodian, exactly as the gas lamp in a lighthouse requires a custodian as a guarantee against failure. The same end, viz., the concentration of the whole mechanical and electrical apparatus, under one pair of eyes, could be attained, of course, in other ways: accumulators could be used, or a petroleum engine; but in order to give definitions and afford facilities for criticism, the better course will be to describe a suitable machinery, state what it will do, what attendance it will require and what it will cost.

I propose, then, for an electric lighthouse, where small outlay is essential, the following: A Dowson gas-producing apparatus and gas holder, the generator and superheater being in duplicate, each capable of making 1,200 feet of gas per hour, the gas holder having a capacity of 3,000 cubic feet; an 8-horse nominal Otto gas engine and series wound dynamo machine, placed in a room near the base of the tower, and copper conductors to the lantern, the dynamo having magnet coils divided into sections so as to supply a small current when required; a one horse nominal Otto gas engine and dynamo machine placed in the room immediately below the lantern floor, with gas pipe from the gas holder; one spare armature; current and potential galvanometers and switches; three electric lamps to receive either carbons of 25 mms. diameter, or any lesser size, with complete adjustments for accurate focusing; the positive carbon below; one paraffin lamp as a stand-by; an optical apparatus of the second order, 70 cms. focal distance, extending from 29° below the horizontal to 80° above. The cost of this apparatus would depend upon the character of the light it was intended to exhibit. To fix ideas, let it be assumed that the light is to be a half minute revolving light, showing all round the lighthouse. There could then be supplied a 16-sided apparatus, with pedestal and revolving machinery. Provision would be made in the optical apparatus for giving the horizontal and vertical divergence desired by the same methods successfully used in the lighthouses of Macquarie and Tino.

Two focusing prisms would be fixed to form magnified images of the arc on pieces of obscured glass let into the pedestal floor, so that the keeper, whether in the lantern or in the engine room, can see at a glance the state of the arc, and observe whether it is of proper length with the carbons in line, whether it is exactly at the right height and in the centre of the apparatus. An error of one mm. would be glaringly apparent and call for immediate adjustment, although its effect would be only a displacement of the beam five minutes of angle. The lantern would be 10 ft. diameter with bent plate glass. The cost of the whole of the above described would be materially less than £3,400, the cost of a first order light and lantern with oil lamp and large burners.

Let us now see what result would be obtained. In fine weather, the small engine would be used. Its effective power on the brake is fully 1½ horse-power; from this 1½ horse-power the dynamo machine produces considerably over 800 watts, say 800 watts on the arc itself, or 20 ampères through a fairly long arc of 40 volts. Of course, the value of this in candles depends upon the color in which it is measured and the direction in relation to the axis of the carbons. In red light, the mean over the sphere would certainly exceed 1,200 candles. In clear weather, or in slight haze or rain, the beam of this light through the lenses would be much more powerful at the horizon and on the distant sea than any single focus light in oil or gas, or at least would be fairly comparable with anything yet exhibited with oil or gas, whether triform or quadriform. But on the nearer sea the illumination would be reduced, so that no annoyance would be caused by dazzling flashes.

In really thick weather, or, indeed, in any weather when there was a doubt as to the visibility at the horizon of the lower power, the large engine would be used under the superintendence of the second keeper. This engine will give ten horse-power on the brake, and there is no difficulty in obtaining eighty-five per cent. of this as useful electrical energy outside the machine, that is 6,340 watts. From this deduct 10 per cent. for the lead and the lamp, and for steadying the arc, leaving 5,710 watts in the arc itself, or 114 ampères, with a difference of potential of 50 volts. Having regard to the fact that the optical apparatus here proposed acts upon a larger portion of the sphere than that used in the South Foreland experiments, that the vertical divergence is less, and that the potential difference is greater, and the current continuous, although less in quantity, we may safely assume that the power of the resulting beam would not be inferior; indeed, the maximum number of watts actually developed in the arc in the lantern in the South Foreland experiments must have been materially less than $175 \times 40 = 7{,}000$ watts.

It hence follows from the South Foreland experiments

FIG. 1.—NOVEL BURGLAR ALARM.

that in any fog whatever the flashes would penetrate farther than those of any existing gas or oil light. The increased size of crater compared with that produced by the current of 20 ampères will give increased vertical divergence and so cause the maximum illumination to be obtained at a less distance from the lighthouse. The attendance of two men would suffice for all the duties of the lighthouse, because under ordinary circumstances one only need be on duty excepting while gas is being made. The usual course would be that with the exception of from 2 to 3 hours at the beginning of the night, the gas producer would be damped down, and when the

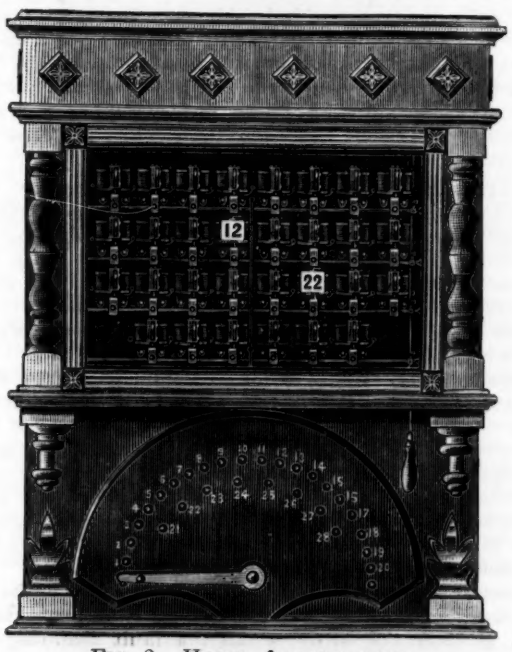


FIG. 2.—HOTEL ANNUNCIATOR.

small engine was at work the supply be taken from the gas holder. Consider the case of a long night of 15 hours. Immediately before lighting up, the producer would be put to work, and would require occasional attention from one keeper, but not his continued presence. For the first three hours of the night the engine would be using between 230 and 240 cubic feet of gas per hour, and the producer supplying between 1,200 and 1,300 ft., so that at the end of three hours there would be a store of 3,000 cubic feet, more than sufficient for the night unless thick weather come on, so that after three hours one keeper only would be on duty at a time, and he would always be in attendance on the light. In the event of a fog the keeper on duty would ring up his mate, who would start the larger engine and set the producer to work, and remain in attendance on engine and producer so long as the weather continued thick. A staff of two is adequate at all times, but it is true that more work would have to be done both by day and night, about two hours in gas making and perhaps one hour in additional cleaning of machinery. It would be a question of expediency, depending upon the amount of thick weather to be provided for, whether a third man should be employed, or additional pay be given to two men for the additional work demanded from them. Adopting the latter course, the extra attendance would be covered by £35 a year, with an extra allowance when full power is in use.

The consumption of coal would be 4 lbs. per hour of lighting, of water about half a gallon, of carbon about 4 in. per hour, allowing for ends wasted. Comparing with an ordinary first order light illuminated with paraffin the account for lower power would stand somewhat thus:

Credit.

Oil and wicks and glass chimneys, an expense varying with time and place, but not less than annually.....	£85 0 0

Debit.

Coal—9 tons at 25s...	£11 5 0
Wages	30 0 0
Oil and waste.....	6 0 0
Carbons—1,460 ft. at £10 per 100 ft.....	14 12 0
Extra repairs and contingencies.....	15 0 0
	£76 17 0

which suffices to show that the charges would not differ materially from an oil light. The substantial advantage resulting would be that at a trifling cost per hour there is available at any moment a light of the greatest penetrative power.

(TO BE CONCLUDED.)

Improved Burglar Alarm and Hotel Annunciator.

Among the various electrical appliances, machinery and supplies manufactured by the Utica Fire Alarm Company, of Utica, N. Y., are the hotel annunciator and burglar alarm, shown in the illustrations, Figs. 1 and 2. The "drops" in both apparatus are mounted on vertical pivots, and the numbers are obscured from view, being maintained in that position by latches attached to the armatures of the electro-magnets. When current is sent through the magnet, the latch is drawn down, and a spring throws the drop outward, exposing the number. The hotel annunciator is also provided with the fire-call, by which the clerk in the office can send in an alarm to every room on turning the lever shown, so as to make successive contact with the stops arranged circularly around it.

The burglar alarm is provided with the usual means for making tests of the circuits, including the silent and battery tests.

A Complaint Against the Patent Office.

To the Editor of The Electrical World:

SIR: I desire to call attention to a marked case of dereliction of duty on the part of the Patent Office in allowing patents to issue to J. T. Carty and J. A. Barrett (Nos. 348,512 and 350,715) without declaring an interference with my case of "Duplex Telephony," filed previous to either of these cases, and with claims covering both cases. It so happens that both these cases are assigned to the American Telephone and Telegraph Company of New York.

ABNER M. ROSEBRUGH.

TORONTO, Can.

The Hughes Effects.

To the Editor of The Electrical World:

SIR: (1.) From the concluding article of Prof. Hughes in your issue of Aug. 14, would you infer that small electro-magnets of the bell, telegraph or relay size would be better if the cores were made of iron wire rather than solid iron? Or would the inductive effect be too great to insure good insulation? (2.) Why do the inspectors of the Boston Tariff Association insist on acid as a flux rather than resin, when it is well known that much trouble is experienced by reason of acid corroding wires so that the circuit is often entirely broken?

R. R. E.

MANCHESTER, N. H.

ANSWER.—(1.) The magnets if provided with wire cores would acquire and lose their magnetism quicker with the change of current, and in that respect would be better than the solid cores; but the spark would be considerably increased by the greater inductive effect. The insulation would probably not suffer. (2.) Opinions differ on this point. Perhaps the Boston Tariff Association can best answer this question for themselves.

Eccentric Electricity.—The following graphic item is from the Denver *Republican:* "An electric storm got loose out in Oregon the other day and almost frightened to death two attachés of the United States Geological Survey who were sketching the topography of the surrounding country from the summit of a high peak near Dixie Butte. The first intimation they got of anything unusual was a buzzing sound seemingly coming from beneath their drawing table, on which Mr. Walsh was working at the time, while, a short distance off under the shadow of a rock, slept his partner, Mr. Tweedy. In detailing the happening, a local paper goes on to tell that on putting his hand beneath the drawing sheet Mr. Tweedy received an electric shock which sent him staggering back. The projecting rocks at the same time gave forth a humming, musical sound, and all the surrounding air was evidently surcharged with electricity, passing into the mountain peak through all the crags and projecting points. The peaceful slumbers of Mr. Tweedy were disturbed at this time and he jumped to his feet, but was content to lie down quickly, as when they were standing up the electric fluid entered them in such quantity as to cause a feeling like the pricking of needles. Their hair stood up like bristles, their muscles twisted, and, not having a contract to serve as lightning-rods for that peak, they gathered up their instruments hurriedly and beat a hasty retreat down the mountain's side to the middle fork of the John Day."

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Nov. 8, 1886.

The Waterloo and Seneca Falls, N. Y., Electric Light Company, of Waterloo, was incorporated lately. It will use the Excelsior system, and will run arc lights by power derived from the Seneca Falls, four miles distant from Waterloo. The lights are to be of 2,000 c. p., and I am informed that in the large town of Seneca Falls also a start with 35 arcs of 2,000 c. p. will be made on the same circuits. This preference of 2,000 c. p. lights to those of 1,200 c. p. is notable.

There is little new to be said about the Telotype Company, of which you have already made mention. The offices are on the third floor at No. 30 Broad street. One of the new things there is the motor used for Mr. E. J. Mallett's telotype system of "tickers." It buzzes away at a rare rate, and the current running it with the ticker is said to be only one ampère and five volts.

It is perhaps appropriate that the "telotype" should have a near neighbor in the "teleseme," which is on the fourth floor of the same building, under the control of the Herzog Teleseme Company. The system is a very ingenious method of enabling a guest in a hotel to give notice of about 250 wants without leaving his apartments, and hence the "bell-boy" fiend that dances incessantly all over the place is abolished. Thus if staying, say, at the Buckingham, you can order a 5-cent native cigar and a bottle of 1886 Ohio port by simply setting an indicator which conveys the messages electrically to the office, and you can also by the same means order the hospital ambulance when you have discussed those luxuries.

The Safety Electric Railway and Power Company of this city, operating under the Daft patents, has, through its president, Mr. J. Murray Mitchell, secured the contract for equipping the Pittsburgh, Knoxville & St. Clair Railway with the well-known Daft system. The road is to cost, it is said, $120,000. There will be five motor cars of 30 h. p. each. Overhead and sunken conductors will be used. The grades on the road run as high as 750 feet to the mile, and there is a curve of 50 feet radius on the steepest grade. The line also includes trestlework. A speed of 10 miles an hour is guaranteed. The electrical apparatus is now being made at the Greenville factory, N. J. The Safety Company has other important work in hand as well.

Mr. Harry Hall has become the New York representative, at 15 Cortlandt street, of the American Electrical Works, vice Col. G. L. Beetle, who has joined the forces of the Western Electric Company.

A vigorous protest against the erection of any more telegraph poles in Classon avenue, Brooklyn, was filed with Mayor Whitney last week, and a delegation of property owners stated their grievances to him. The poles are unusually large, and each is designed to carry 25 wires. The Mayor said he thought the poles would have to go.

The Edison people have a forceful way of stating their points. Here is an extremely good paragraph from a circular just issued by them: "By way of conveying to your mind an idea of the extent to which the Edison incandescent light is to-day actually employed, the following suggestive comparison is made. There are in every-day use to-day about 400,000 Edison lamps, of an average of 16 candles each. Reduced to a gas basis for the purpose of comparison, this would appear thus: 400,000 lamps, 16 c. each, is equal to 400,000 6-foot gas jets, or 57,600,000 cubic feet per day. In the *City Record* of Feb. 25, 1886, the official returns from S. McCormick, Superintendent of Lamps and Gas, show that the total capacity of the eight gas companies supplying New York City is 36,000,000 cubic feet per day. Hence the daily light-producing capacity of the Edison apparatus in use in the United States, whether expended in light or power, is more than 50 per cent. greater than that of the entire combined gas plants of New York City."

Mr. C. H. Carter, of the United States Electrical Company, has begun suit against the Metropolitan Telephone Company for infringement of patents 229,867, granted July 13, 1881, for extension bell, as applied to magnetos and used everywhere on telephones for calling subscribers.

Mr. W. C. Jaynes is the General Manager of the Acme Watchman's Detector Company, 265 Broadway. The company's detector is made under Holtzer's patent, and can, if needed, be combined with an office clock, making a handsome piece of furniture. The detector is in very general use, and the testimonials in regard to it, dating down to the present time, are high in their praise of it.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Nov. 8, 1886.

The cable between Block Island and the main land being broken, the Providence (R. I.) *Journal*, it is said, obtained its election returns from the sea-girt isle by carrier pigeon.

Advices from Martha's Vineyard state that the signal service will be removed from Cottage City to Vineyard Haven during the winter, where it will be located at the Mansion House.

A telephone circuit between Gay Head, Vineyard Haven, and several other points on Martha's Vineyard Island has been completed, 376 poles and 14 miles of wire having been used in its construction.

Mr. James A. Derrom, General Agent of the Inter-Continental Telephone Company, has just returned from Caracas, South America. Recently this gentleman equipped the Caracas telephone exchange with a Western Electric Company's new multiple board of 600 drops.

The Lowell free course of lectures has already begun at the Massachusetts Institute of Technology, this city. The ten lectures (with laboratory exercises) on "Elementary Electrical Measurements," by Associate Professor Holman, will be given on Fridays at 7 P. M., beginning Dec. 3.

The Amesbury, Mass., Electric Light Company started up its dynamos for the first time, with fourteen arc lights in circuit, on the evening of Nov. 3. The lights burned clearly and steadily, and the citizens of Amesbury were enthusiastic over the brilliant illumination.

At a meeting of the Cambridge, Mass., aldermen on the evening of Nov. 3, a hearing was given on the petition of the Thomson-Houston Electric Company for permission to erect poles in various streets of the city for the purpose of introducing its system of electric lighting.

Mr. F. A. Robbins, of Pittsfield, Mass., has just finished the installation of an incandescent light plant, Westinghouse system, in that city.

The addition to the factory of the Bridgeport Brass Company is about finished, and the new machinery is being rapidly put in position. It is expected that everything will be in shape to start up work in the new building about December 1, thus increasing the production of wire for electrical purposes by this company nearly 25 per cent.

A dispatch from Ottawa, Ontario, dated November 5, contains the following menace to Canadian exiles: Failing to get hold of Stewart, who recently embezzled $2,000 from the Western Union Telegraph Company at Wichita, Kan., and fled to Canada, the company has begun suit against him in the Winnipeg courts under the Dominion statute which provides that any one bringing any stolen property or property obtained by fraud into Canada shall be subject to the same punishment as if the stealing had taken place in Canada. The prosecution will be required to prove that he had in his possession the whole or part of the money actually stolen. The result of this case, if Stewart is convicted, may lead to several other prosections under the same statute in which extradition has failed.

The up-and-down or "see-saw" quotations in telephone stocks just now are keeping many on the anxious bench. The following clippings from the financial columns of the Boston *Sunday Globe* and Boston *Sunday Record* (Nov. 7) will be read with interest. The former observes:

"Bell Telephone sold off from 214 to 208, on the following circular issued to-day: 'To the 16,000 telephone subscribers and the 2,000 stockholders of the New England Telephone Company,' and stating that 'all who are ready to co-operate in a movement to secure the passage of laws by the General Court of Massachusetts limiting the rental to be charged by the American Bell Telephone are requested to send their address to the Secretary of the New England Telephone League, Box 2567, Boston, Mass.' The circular concludes: 'Immediate steps are to be taken to organize for action in every county.' Erie gained 1⅛ to 30 and then dropped to 29. One reason for the move in both Bell and Erie is said to be due to the confirmation of the rumor that the Bell Company had secured a permanent injunction against the Pan-Electric telephone companies in Texas, and that the Pan companies were given sixty days to close out their business. The Erie Company, which operates as a part of its territory the State of Texas, was also very materially affected by this decision."

The latter thus gives its opinion: "Conflicting opinions prevail in regard to the value of Bell Telephone. Within the next few weeks additional attention may be attracted to Erie Telephone, from the fact that its contract for the use of the Bell patents in St. Paul and Minneapolis expires in January, 1887, according to the opinion of the American Bell Company. The Erie Company claims, however, that its Minnesota contracts do not expire January 1, but are perpetual. The grounds upon which the Erie company bases this claim are as follows: 'In 1878, the Bell Telephone Company licensed a gentleman named Haskins as their perpetual agent in the Northwest, with the privilege of organizing and sub-letting exchanges. Mr. Haskins assigned his rights to a man named Hankinson, and the latter delegated the Northwestern Telephone Exchange Company as one of the parties to whom the Bell Company should issue a direct license under its perpetual arrangement with Hankinson. The Bell Company issued such a license in January, 1879, for four years, and renewed it for four years more in January, 1883. In July, 1883, the Erie Company became the possessor of all the rights and properties of the Northwestern Telephone Company, as well as of Hankinson, and claims that it thereby acquired the right to a perpetual renewal of its contract.'"

The Pawtucket (R. I.) Electric Lighting Company have purchased and remodeled the property known as the Bosworth Mill in that city and have equipped it with necessary dynamos and machinery for furnishing current to incandescent lamps. The company intend running a day circuit for supplying power. Four Sprague motors have just been ordered for this purpose as a start, and it is predicted that it is the beginning of a large power business by the company in the section named.

Messrs. Paine & Francis, agents for the Edison United Manufacturing Company, have recently made the following installations of isolated incandescent plants, viz.: Woolen mill of Benj. Greenbank, Enfield, N. H., 150 16 c. p. lamps; Mechanical Refrigerator Company, Boston, 50 16 c. p. lamps; D. S. McDonald's restaurant, Boston, 75 16 c. p. lamps; and at the silk spinning mill of Phipps & Train, Newton Upper Falls, 200 16 c. p. lamps. An increase in the large plant at Woburn (N. J. Simonds') of 200 16 c. p. lamps was made last week.

Extensive improvements are being pushed forward at the Central station of the Edison Electric Illuminating Company in this city. Since the first starting of this enterprise, Feb. 20, 1886, with 600 Edison lamps, it has not only proven a success, but the constant demand for lights has kept the promoters busy enlarging and equipping the dynamo and engine rooms, thus increasing the lighting capacity of the station, until now it has been found necessary to erect a larger building. On Aug. 9 the number of lights was increased from 600 to 3,000, and at this writing 5,500 are connected.

Ground has been broken for an additional building two stories high 58×78 feet. The foundation will be made of sufficient strength to admit of three additional floors being erected next Spring, making in all five floors and basement. Tubing is now being put down for 10,000 lights, which will eventually be increased to 40,000. The system of lighting used is Edison's three wire underground; and the station is conducted on the meter system. The new building will be fire-proof throughout; and when the three upper stories are added the fourth and fifth floors will be rented for manufacturing purposes and will be supplied with electric power, light and heat for steam. Every floor will be constructed of concrete, and no expense will be spared to make the entire building one of the most substantial and magnificent of its size in the country.

Under the present management—Mr. Wm. J. Hammer—the station is being systematically and successfully conducted.

George K. Blodgett, the electrician of the Boston & Albany Railroad, has begun a series of lectures at the Massachusetts Institute of Technology to the fourth year electrical and railroad engineers on "The Application of Electricity to Railroads."

The autumn meeting of the National Academy of Science will be held in the new building, at the Massachusetts Institute of Technology, from Nov. 9 to Nov. 11, or possibly 12. Professor O. C. Marsh, of New Haven, is president. The scientific sessions will begin each day at 12 o'clock in room 14.

W. I. B.

PHILADELPHIA NOTES.

PHILADELPHIA, Nov. 8, 1886.

The electric railway car, which has been running daily on Ridge avenue, near Laurel Hill, was taken off last Saturday, the reason being that the demonstration has been satisfactory and that the company (the Union Electric) is about to establish a factory for the purpose of manufacturing "electric machinery and appliances." On the same day (Saturday) William L. McDowell, who has been operating the car on Ridge avenue, made application to the Commissioners of Fairmount Park for permission to construct an electric railway in the West Park, stating that the scheme was a pronounced success and promising not to charge more than 5-cent fares. The application was referred to a committee. Such a road is sorely needed in the park, for without it two-thirds of Philadelphia's population can never see—have never seen—the extreme end of the park, the distance there and back (20 miles) being too great to travel in the ordinary way in one day. The entire absence of cinders, sparks, smoke and noise in an electric motor is proof enough that electricity is the only locomotive power for such a beautiful park. Moreover, such a road (elevated) would pay from the start.

At last Wednesday's meeting of the Electrical Committee of Councils an ordinance granting the Western Union Telegraph Company permission to lay and maintain underground wires, conduits and cables, and to construct the necessary manholes, from Third and Chestnut streets to Dock, along Dock to Walnut and thence along Walnut street to the Delaware River, was ordered to be favorably reported to Councils. The ordinance recites that this privilege does not grant the company the exclusive right on the streets named. The ordinance also contains the proviso that the work shall be completed before December 1, 1887. Favorable action was also taken on a petition of the Philadelphia Time Telegraph Company to lay wires from the Delaware River to Broad street, and from Cherry to Vine. The ordinance provides that the line of wires shall be used only for the purpose of transmitting electric standard time.

On the following day, Thursday, the Bell Telephone people made another attempt to obtain permission to place their wires underground, but the local statesmen objected as before, and the matter was again laid over.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Nov. 6, 1886.

I send you the following interesting statement of street and other railways now being run every day successfully on the Van Depoele Electric Railway System. Some of them have been running over nine months continuously:

Appleton, Wis.; operated by the Appleton Electric Street Railway Company; 4½ miles road and 5 cars; cars run separately; electricity generated by water power.

Montgomery, Ala.; operated by Capital City Street Railway Company; 2 miles of road and 2 cars; plant being completed to 10 miles road and 12 cars; steam power.

Detroit, Mich.; the Dix road; 2½ miles of road, and train of 4 cars; steam power.

Port Huron, Mich.; operated by Port Huron Electric Street Railway Company; 4 miles of road and 4 cars.

Windsor, Ont.; operated by Windsor Electric Railway Company; 2 miles road and train of 2 cars.

Scranton, Pa.; being put in for Scranton Suburban Railway Company; 3 miles road and 2 cars; also increase to number of roads now in operation.

The following is from the Dayton, O., *Democrat* as to the working of the Edwards locomotive headlight:

The dynamo is located under the fireman's seat. Only one carbon is used, and if by any means the electricity or the mechanism were to fail, the oil lamp is so fixed that it could be instantly lighted in its stead. However, although prepared for this contingency, the inventor does not anticipate any failure on the part of the lamp, which is as near simplicity and perfection as time, money and brains can make it.

Eight trips have been made by the Eastern express, on the Little Miami, on which the headlight was tested and proved successful beyond the expectations of the most sanguine. The Dayton party left this city for Xenia at 9 o'clock, arriving at that place in time to catch the "headlight" train. The trip in the cab of the engine was one filled with novel experiences. The lamp burnt steadily without a flicker, throwing a stream of light down the track for miles. The train was a fast one, but all the bumps and jolts of the sixty-miles-an-hour pace of the iron horse failed to interfere with the steady glare in the slightest. Objects, and especially white ones, could be seen at a distance of three to four miles. A white house was plainly visible an immense distance away, and the yellow light of a coal oil lamp in one of the windows. A strange thing is the distinctness with which colors could be distinguished. The red lanterns of signals or switches were plainly visible a mile distant, as were also cattle-guards and crossings. For a mile ahead every tie was distinctly visible; chipmunks, rabbits and other small animals aroused by the glare could be seen running across the track. A wonderful test was made of the penetration of the light. Four and a half miles from the train at a depot several gentlemen read papers and letters by the light. This is an actual fact and is easily susceptible of proof.

One more advantage of the light: Not only can switch lamps be plainly seen, but, if the lamp is out, the headlight will show by the board or day signal the position of the switch at a distance sufficient to allow the train to be brought to a stand-still. At the very least, at a distance of 500 feet the light shows the track so distinctly as to enable the engineer to see whether the switch is open or closed regardless of the switch target. The headlight will also

give persons at crossings from three to five minutes' warning of the approach of the train. W. A. K.

THE TELEGRAPH.

Hoboken, N. J., will by Christmas Day, it is said, have a fire-alarm telegraph system in operation.

Formosa.—The Governor of Formosa has, it is stated, contracted with a German firm for the construction of a telegraph line on that island.

The Commercial Ticker.—Lest there should be doubt on the question, President John Anderson says: "All reports that the Commercial Telegram Company has sold out or has come under the control of, or is negotiating with, any other corporation for these purposes, are absolutely false and without foundation."

Sacrificed the Anchor.—The United States fish commissioners' schooner "Grampus," while fishing, for scientific purposes, on its last voyage, anchored near or on Jeffrey's ledge. In attempting to weigh their anchor the crew fouled an Atlantic telegraph cable, and were obliged to cut their hawser, thereby losing part of the same and an anchor.

Buffalo Electrical Society.—At the last meeting of this society, Mr. W. Finn, of the Western Union office, delivered a lecture on "Electrical Terms." The lecture was a clear and interesting explanation of the ordinary terms of electrical work, such as "potential," "resistance" and "current." He also pointed out the differences between various classes of conductors and gave an account of the investigations of Prof. Hughes. At the next meeting, on Nov. 19, Dr. J. D. Bonnar will read a paper on "The Medical Uses of Electricity."

T. M. B. A. Annual Meeting.—The annual meeting of the Telegraphers' Mutual Benefit Association is to be held, as previously announced, on Wednesday, 17th inst., at 4 P. M., in the Western Union Building, 195 Broadway. In view of the importance of the amendments proposed in the constitution, etc., it is highly desirable that members should be in attendance or should send in their proxies to the Secretary.

Won by the United Lines.—Judge Blodgett, Chicago, has issued an order directing L. L. Parker, receiver of the Bankers & Merchants' Telegraph Company, to turn over the possession of that line, with its effects and equipments, as well as the Board of Trade Telegraph Company property, to an agent of E. S. Stokes' United Lines Telegraph Company, of which these lines will hereafter form component parts. Col. Robert G. Ingersoll represented Stokes and others, who are owners of all the judgments against the Bankers & Merchants' Company, which was conveyed some time since to the United Lines Telegraph Company by a duly recorded conveyance. The Board of Trade Telegraph Company was bought up by Stokes at the New York sale. The latter company's lines had, however, been leased to the Bankers & Merchants' Company. Judge Blodgett declared this lease forfeited for failure to comply with the rental conditions, and Stokes now comes into possession. Parker, as receiver, is to pay the Board of Trade Telegraph Company $4,000, and the question of rentals due the latter company by the Bankers & Merchants' Company is referred to Master in Chancery Sherman.

THE TELEPHONE.

Canada.—The Bell telephone patent suits in Canada will soon come before the Dominion Commissioner of Agriculture again, it is reported.

Rochester, N. Y.—The Common Council, at a special meeting on Nov. 5, revoked the license granted three years ago to the Buffalo Bell Telephone Company to erect poles for wires in the streets. This action is due to the recent trouble over the change in rates.

In the U. S. Supreme Court.—A dispatch of Nov. 8 from Washington says: The Supreme Court to-day granted the motion made last week to advance and hear together the telephone cases—six in number—now on the docket, and ordered that they be set for argument as one case on Jan. 24 at the head of the calendar.

Pan-Electric Enjoined.—Judges Pardee and McCormick, of the U. S. Circuit Court at Dallas, Tex., on Nov. 5, by consent of both parties to the suit, granted a preliminary injunction in favor of the American Bell Telephone Company against the Pan-Electric companies operating at Dallas, Fort Worth, Denison and Abilene, and upon request of defendants allowed them ninety days within which to operate their telephones, but required them to be removed after that time. The court sustained the plea to jurisdiction filed in behalf of A. H. Garland, Isham G. Harris and other non-resident defendants.

Boston Busybodies.—The effort to induce the Massachusetts Legislature to interfere with the Bell Company came to naught last year, as did similar efforts in other States except Indiana, where the results of hostile legislation have been to well-nigh deprive that State of telephone service, and produced no end of trouble. That any further interference with the company's business will be made this year in this State is highly doubtful. There are, withal, some people on the street who are curious to know who the parties are who form the "New England Telephone League," and who are inclined to regard their circular as most all business men do all anonymous communications.—*Boston Transcript.*

St. Louis, Mo.—At St. Louis the Court of Appeals has affirmed the judgment of the Circuit Court in favor of the Bell Telephone Company in its tussle with the Board of Public Improvements relative to a permit for poles on the streets. The Board had withheld a permit for the use of the streets on the ground that the company had refused to comply with certain conditions. The question to be determined was whether the Board of Public Improvements had the power to oblige a corporation which may desire to erect telephone poles and establish telephone wires in this city to enter into a stipulation to grant to any other company requiring electric wires for its business the right to use one or more cross-bars at an annual rental. The Board was empowered, says the Court of Appeals, by ordinance, to make laws and regulations for the transaction of its own business, but it had no power to establish such regulations in respect of telephone companies as those complained of by the Bell Company. The Circuit Court sustained the position taken by the Bell Company and ordered a peremptory writ of mandamus to issue against the Board of Improvements. The Court of Appeals affirms that decision.

THE ELECTRIC LIGHT.

Saccarappa, Me.—Five of the mills and factories at this manufacturing centre are now lighted by electricity.

Colorado Springs, Col.—Messrs. W. A. McIntire and C. H. White are interested in the plant for this place.

Yonkers, N. Y.—The Schuyler Electric Light Company, of this place, organized by J. R. O'Brien and others, has a capital stock of $100,000.

Cook County, Ill.—The Cook County Electric Light Company has a capital stock of $500,000. The incorporators are F. H. Collier, C. M. Walker and C. N. Nichols.

Dalton, Mass.—Mr. Byron Weston has started up an Edison plant at his paper mills, Dalton, Mass., using an Armington & Sims engine, supplied by the Jarvis Company, of Boston.

For Felt Works.—The Edison Company has closed a contract with Alfred Dolge & Co., proprietors of the felt works at Dolgeville, to put in 500 incandescent lights. This building is four stories high and 700 feet in length. The plant is to be installed and in running order by Nov. 20.

Lowell, Mass.—About a year ago the Merrimack Manufacturing Company introduced the Weston incandescent electric lights into their print works, to the great satisfaction of the operatives. The past week, August Ludlam has ordered that 1,000 lights of 16 candle-power be introduced in all departments of the cotton mills.

Electricity's Good Work.—Speaking of "the light of other days," how rapid has been the change from pine knots to tallow dips, from tallow dips to whale oil, from whale oil to lard oil and camphene, from these to kerosene, and from gas to electricity—all within one lifetime. If the light of the future goes on at the same rate darkness will be a thing of the past.—*Gloucester (Mass.) Advertiser.*

Davenport, Ia.—A gentleman in Davenport, Iowa, whose home is but 100 feet from an electric light tower, the light of which falls unobstructedly upon his flower garden, says his lilies, which ordinarily bloom early in the daytime, open in the night, and that the morning-glories will unclose in the night, a few minutes after the tower lights brighten the air.

Greenport, N. Y.—The Greenport City Electric Light and Power Company has been organized with a capital stock of $10,000. The officers are G. F. Tuthill, president; G. H. Corwin, treasurer; B. H. Skinner, vice-president; W. F. Hammond, secretary; and B. H. Reeves, attorney. Work will begin at once on the plant. The Thomson-Houston arc and incandescent systems are to be used. Enough contracts have already been made to place the company on the list of dividend-payers.

Brookline, Mass.—The Jarvis Engineering Company have received the contract to erect a steam plant for the Suburban Electric Light and Power Company, to be started in Brookline, Mass., to furnish electric lights in Brighton, Allston and Jamaica Plain. They will use an Armington & Sims engine and a steel tubular boiler set with the Jarvis patent boiler setting, also National feed water and Korting double tube injector. They will use the American Company's (Wood) system of arc light.

Harrisburg, Pa.—The Edison Illuminating Company, Harrisburg, Pa., was started in March, 1885, and has been a financial success from the outset. Their steam boilers were set with the Jarvis patent boiler setting, to burn coal screenings from the mines. The success of this electrical station proving so satisfactory, a number of the stockholders have decided to erect a station to run steam through the streets for heating and power purposes. They will use six steam boilers with the Jarvis setting, to burn the same quality of cheap fuel.

The Indianapolis Jenney Light.—Besides carrying off the Bay City, Mich., contract, the Indianapolis Jenney Electric Company has, it reports, been very busy on a number of large orders. During the past two months it has closed contracts of sale for plants at Tullahoma, Tenn., Cincinnati and Eaton, O., and has supplied additional arc apparatus to Brazil, Ind., and Clarksville, Tenn. It has sold an arc and incandescent plant for Auckland, New Zealand, a 400 incandescent plant to the Greencastle, Ind., Company, and a large number of isolated plants of from 30 to 100 incandescent lights each. So great has been the demand for its apparatus, that the company is now ordering new machinery and doubling its productive capacity.

APPLICATIONS OF POWER.

Chicago.—The Electric Elevated Railway Company has been incorporated by C. W. Rigdon, S. S. Willard and G. P. Everhart, with a capital stock of $5,000,000. The company proposes to operate elevated roads by electricity in Chicago and Cook County, Ill.

An Electric Boat.—Trials have been made on the Spree at Berlin with the "Electra," belonging to Messrs. Siemens and Halske, in presence of a number of prominent engineers. The boat is propelled in the usual way by a storage battery and electric motor, working a screw of peculiar construction, and, as far as can be judged from the short trial just made, has proved a success.

The Electric Launch "Volta."—On Saturday last, says the London *Electrical Review* of Oct. 29, at the instance of Major-General Fred. Brine, a further trial of the capabilities of the electric launch, the "Volta," was made on the lower reaches of the Thames, in the presence of General Lord Chelmsford and other officers of both branches of the service. Those present included General Pritchard, General Sir R. Pollock, General Sir H. de Bathe, Admiral Sir Erasmus Ommanney, Admiral Curme, Captain Palliser and Captain Murphy. The trip was from Westminster Bridge to Greenwich Hospital, where the party were entertained by Admiral Brandreth. Complete satisfaction was expressed by all present with the speed attained, averaging something over six miles and a half per hour. Next year, we understand, it is the intention of the firm to whom the "Volta" belongs to put other electric launches on the upper Thames for pleasure purposes.

Printing by Electricity.—The *American Inventor*, of Cincinnati, a large monthly journal, says: "We print this month's issue for the first time by means of electricity. This is the first plant of the kind in this State. The Sprague motor is used, and is an immense advance on any other kind of power. We are running four presses with a single motor, and it is quite a novelty in this section. The *Inventor* printing establishment is the most complete of its kind in the country, and being equipped in addition with a large force of designers and engravers, every opportunity is afforded for doing first-class work expeditiously. We welcome our friends at any time to see this 'power of the future' in practical operation. This motor is built in a very substantial manner, and there are no parts that wear rapidly, even with ordinary care. The expense for repairs cannot amount to 10 per cent. of that required for either steam, gas or hot-air engines, and we now see no reason why it will not give for many years to come as good results as at present."

Philadelphia Points.—The *Record* has the following important item, which is of more than ordinary significance: "Although the Traction Company is satisfied with the cable motor and proposes to extend the system in this city, it is looking out for even cheaper and more convenient motive power. Several new and untried systems have been examined by the Traction engineers recently, and one of them has made such a favorable impression that it is to be tried here in a short time. Vice-President Widener said yesterday: 'It is true that we propose to experiment with a new motor, not because we have any trouble with the cable system, but we think it is likely that in the general progress of invention there are other and possibly better systems. I recently went over to New York and rode in an electric motor car, the movement of which pleased me, and I was so favorably impressed that our company propose to experiment with it in this city as soon as a car now being built to suit our roads is finished. The electric-motor power is stored in the car itself, and will run the cars; that much we know. The only question remaining is as to the cost of maintenance of the cars and the furnishing of the motive power. We will put the first car on the Chestnut street line, and if the experiment justifies the change we will, of course, adopt the new motor for that line and probably for others of our system.'"

The Main Motor.—A Boston paper says of this motor: "The motor on a small scale is about to be put on the market for the working of sewing-machines and small machines of a variety of classes. Large-sized motors are now being made for the purpose of applying them to horse-cars. A 10 horse-power motor, which is to be the size applied to street cars, will be some 20 inches in diameter and will weigh some 200 pounds, and will be placed on the front platform. A belt will connect the motor with the front axle, and thus transmit the power which will move the car. The batteries will be placed under the cars. The patent is controlled in New York by the River & Rail Electric Company, and a company is now being organized in Boston to control the patent in Massachusetts and possibly throughout New England. The company propose to retain the ownership of all the motors, and the railway companies are to pay a royalty for their use. The introduction of the motor by the companies would materially reduce the cost of the operating expenses, as it will cost less to run one of these electric motors than it does to feed the horses necessary to move one car. An introduction of this motor would require no outlay on the part of the company for change of tracks or laying a cable, and the company propose to experiment as soon as possible on some of the cars in Boston, and thus show to the satisfaction of the railway company whether or not the invention is worthy of adoption."

PERSONALS.

Mr. Frank Ridlon, of the Brush-Swan Company, Boston, will read a paper before the local Society of Arts on Nov. 11, on "Incandescent Lighting from Arc Light Circuits."

Honors to an Electrician.—The Senate of the Royal University of Ireland has bestowed its highest scientific degree of Doctor of Science upon Prof. John Perry, F. R. S. Prof. Perry is an old graduate of the Dublin University, and this recognition of his undoubted claims to high scientific distinction is, says the London *Electrician* appropriately, as creditable to the magnates of the Senate House as it must be gratifying to the Professor himself.

MISCELLANEOUS NOTES.

Underground Wires in Cleveland.—The judiciary committee of the city council report their opinion that the city has authority to compel electric wires to be placed underground. A minority report holds that the city authorities have no right to pass such an ordinance, and that it is necessary for underground purposes to have a special act of the Legislature.

The Paris International Laboratory.—The municipality of Paris has granted a portion of the site of the old Collége Rollin to the International Society of Electricians for the purpose of the electrical laboratory which is to be built and equipped out of the surplus funds of the Electrical Exhibition of 1881. The laboratory will be open for purposes of research to electricians of every nation, under regulations which will be drawn up by the Society.

Caoutchouc from a European Herb.—According to the *Bulletin de la Société Chimique de Paris*, a plant belonging to the lettuce tribe, scientifically known as *Soachus Oleraceus*, and quite common on the wayside and among dry rubbish heaps in France, has been found to yield a very good quality of caoutchouc. The plants are steeped in carbon bisulphide, and afterward boiled in alcohol and caustic potash. About 4.3 per cent. of the weight is thus obtained as caoutchouc.

The Insulating Power of Gases.—M. Jean Luvini has recently communicated to the French Academy of Sciences the results of a series of experiments, which have led the author to the general conclusion that, under all pressures and at all tempera-

tures, gases and vapors are perfect insulators, and that they cannot be electrified by friction, either with themselves or with solid or liquid bodies. Hence, to suppose that very rarefied gases, or gases at very high temperatures, are conductors, is a mistake, due to confusion between resistance to disruptive and conductive discharges.

Twelve Patents per Diem.—Glasgow lays claim to possessing the most prolific inventor on record, Mr. David Cook, an electrical engineer in that city, having taken out the largest number of patents ever issued to one individual in one day, viz., twelve. The previous best on record was held by Thomas A. Edison, who has taken out nine patents within the space of a day or two. Mr. Cook is not by any means exhausted, for he is at present perfecting some further electrical appliances, which, with those already patented, will largely embody his experience in practical electrical engineering, upon which he has been engaged for a number of years.—*Industrial World.*

The Benjamin Franklin Trust Fund.—The immortal Benjamin left by his will a fund of $50,000, which is administered by the City Board of Trusts. The original sum of $50,000 has grown to $65,220. It is a significant fact that the entire amount now loaned to artificers is about $5,000. Those who desire to apply for this fund must make their application to Mr. C. S. Roulon, 19 South Twelfth street, between the hour of 10 A. M. and 1 P. M., who will furnish them with a blank on which to make application. They must have learned a trade, and have been indentured apprentices. They must not be over 35 years and be married. If they then furnish two satisfactory securities that they will return the money in ten annual installments, they can secure a loan of $600 on 5 per cent. interest. It is needless to say that there are now but few men under 35 years of age who have been indentured apprentices.—*Phila. Item.*

SPARKS AND FLASHES.

Explanations in Order.—Young husband (to wife)—"Didn't I telegraph you not to bring your mother with you?" Young wife—"I know. That's what she wants to see you about. She read the telegram."

He Doesn't Want to Swim.—Some one says that a man who has been struck by lightning cannot swim. He doesn't want to swim. What he needs, in nine cases out of ten, after being struck by lightning, is a cheap and unostentatious funeral.—*Norristown Herald.*

Rough on "The Front Row."—THE ELECTRICAL WORLD gives prominence to the theory advanced by a New York barber, that "gas light is the cause of baldness." Acts committed "under the gas light" are doubtless not unfrequently the cause that leads to this unfortunate loss, and to just about that extent is gas light responsible for baldness. If THE ELECTRICAL WORLD really believes gas light produces loss of hair, will it kindly inform a suffering public why it is that the *habitués* of the "front row" are, as a rule, noticeably bald on the crown of the head rather than the front of the cranium? If the WORLD is correct, should we not look for the result to make itself apparent on the surface nearest the "glare of the footlights?"—*Progressive Age.*

The California Electric Boy.—The pride of possession no doubt compensates the disadvantages to some extent, but it is evident that so highly developed and powerfully charged an electric boy is liable to conflagrate his surroundings at any time. It does not yet appear whether his flashing eye is capable of setting fire to people as well as things, but it is reasonable to suppose that a current which can burn down a house might have an injurious effect upon a person. Hitherto the boy's parents do not seem to know what to do with him, and, in fact, are clearly embarrassed by his remarkable endowment. But they will have to utilize him, and to do this they must realize what he is. Of course it is apparent that he is a living Faure storage battery, and therefore capable of being put to the same uses. He is more than a Faure battery, however, combining all the functions of a self-acting dynamo with that of storing power. He may be employed to light the town in which he resides, or to furnish power for machinery, or for heating purposes. But there is a use for him which seems specially appropriate, and that is the vitalization of the great American messenger boy.—*New York Tribune.*

BUSINESS NOTICES.

Magneto Bells.—The Viaduct Manufacturing Company, of Baltimore, Md., issues a pretty little steel plate folder, showing on the cover a railway station and a girl signaling a train. It makes special announcement of the company's well-known magneto bells, and quotes low prices on them.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver steel and iron wire, shafting tools, etc.

Anti-Magnetic Shields.—Messrs. Giles Bros. & Co., Chicago, Ill.: Gentlemen: Your Anti-Magnetic Shield for Watches cannot be overestimated. It is now very near eight months that I have worn my watch, and to-day it is, without ever correcting time, about one minute slow. Considering the fact that I am every day near Dynamo-Electric Machines in our regular business, the test could not be harder. I could never have believed that the protection was so complete.

In this age of electricity, not only electricians, but every one who needs correct time, should have the Anti-Magnetic Shield. A good deal of practical utility, as well as pleasure, can be derived from a good time-keeper. At present I look upon a watch without a shield as a thing incomplete; and so it is.

Very respectfully, CHAS. J. VAN DEPOELE,
Electrician V. D. P. E. M. Co.

Address GILES BRO. & Co., for particulars, price, etc.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

November 9, 1886.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	.....	40
Am. Tel. & Cable	77½	78
Cen. & So. Am.	75	100
*Com. Tel.	.....	.....
*Gold & Stock	90	95
*Inter. Ocean Tel.	90	95
N. Y. Mutual	.....	.....
Pac. & Atl.	45	55
*Postal T. & C.	.....	.....
South. & Atl.	65	75
W. U. Tel.	78⅛	78¼
W. U. Scrip.	65	.....
W. U. Bonds	.....	121
Mut. U. Bonds	.....	85
TELEPHONE.		
Am. Bell	210½	212½
Am. Speaking	.....	.....
Erie	27¾	28
*Hudson River	.....	55
Mexican	1⅛	.....
*N. Y. & N. J.	85	87½
N. Y. & Pa.	.....	.....
New England	44¼	.....
*Southern Bell	100	130
ELECTRIC LIGHT.		
*Am. Electric	.....	.....
*Brush	.....	.....
*Brush Ill	.....	.....
*Consolidated	.....	.....
*Daft	.....	100
*Edison	152½	.....
*Edison Ill	90	.....
*Edison Isolated	60	.....
*United States	42½	.....
*U. S. Ill	90	.....
MOTOR.		
*Daft	.....	.....
*Sprague	600	.....

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

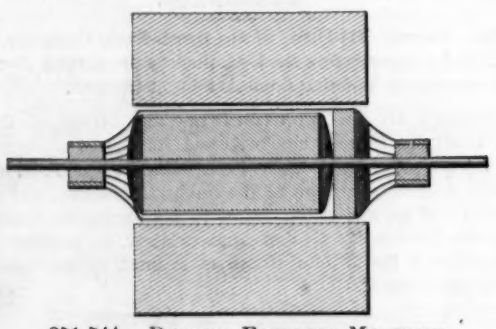
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED OCT. 26, 1886.

351,681. Electric Time Detector; John Cornelius Wilson, Boston, Mass. The object of the invention is to produce a definite signal whenever a watchman has failed to be present within a certain limited time at any station on his route. A clock motor running at a definite rate of speed operates transmitting mechanism unless it is rewound within definite intervals.

351,719. Thermostat; Lawson B. Stone, Marblehead, Mass., Assignor to the American Automatic Fire Alarm Association, Portland, Me. The thermostat consists of two spring terminals and an adjusting screw bearing against one of them to regulate the distance between them.

351,351. Electro-Magnetic Regulator; Thomas E. Adams, Cleveland, O. The invention is set forth broadly in the first claim. The combination with an electric circuit, a main magnet, and a relay or controller magnet included therein, of a shunt circuit around the main magnet, a resistance in the shunt circuit, and devices actuated or controlled by the controller magnet for breaking the shunt circuit. Designed to form an improvement on the Brush regulator, patented Feb. 17, 1880, No. 224,511.



351,544. DYNAMO-ELECTRIC MACHINE.

351,367. System of Telephony and Telegraphy; Charles Langdon-Davies, London, England. [For description see THE ELECTRICAL WORLD of Oct. 16, 1886.]

351,369. Electric Lighting Apparatus; Arthur C. Ferguson, Saratoga Springs, N. Y. The object is to obtain a series of flash lights between electrodes selected from grouped pairs of electrodes to produce a succession of lights in lines corresponding to the outlines of letters and figures or other designs.

351,384. Electro-Mechanical Signal Apparatus; William W. Le Grande, Louisville, Ky., Assignor to H. R Dering, W. W. Dering and T. H. Upperman, same place, and Geo. E. Rockwell, Indianapolis, Ind. Provides means for giving a "clear" signal first to the train having the right of way, and afterward to the other trains in order; and also for preventing a "clear" signal from being given to any section of track unless a train is passing upon that section. The invention relates also to other details.

351,388. Electric Current Indicator; Richard H. Mather, Windsor, Conn. A compound electro-magnet whose armature carries a hammer and a pointer operates to give a signal and an indication when the electromotive force in its circuit changes. [See illustration.]

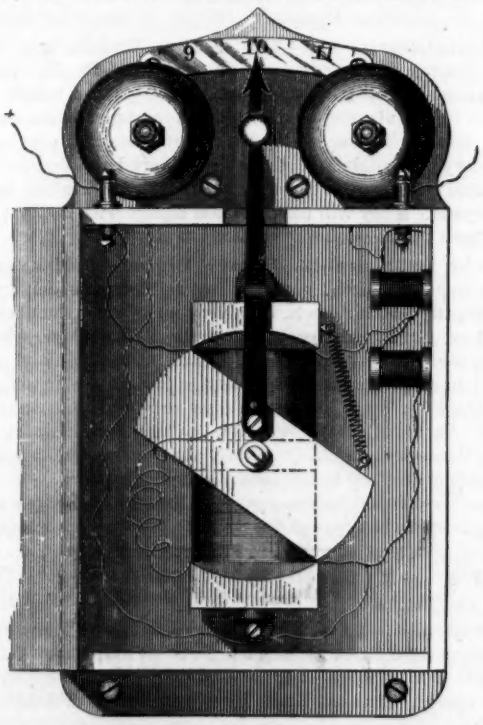
351,389. Arm Support for Telephone Operators; Chester K. Mead, Des Moines, Iowa. The support can be adjusted vertically and horizontally with relation to a transmitter and a receiver, and can be folded closely against the wall when not in use.

351,408. Burglar Alarm System; Philip K. Stern, Toronto, Canada. The premises to be protected are in electrical connection with an alarm station. The invention covers many features of improvement.

351,419. Safety Attachment for Dynamo-Electric Machines; Leonidas G. Woolley, Indianapolis, Ind., Assignor to Henry H. McGaffey and Chester Bradford, same place. A valve in the inlet pipe of the engine which drives the dynamo is connected through intermediate devices with an armature which makes contact with a magnetized portion of the machine. When the circuit is broken, the armature is released and the valve closed. [See illustration.]

351,485. Telegraph Key; John Marion Biggs, Louisville, Ky. The object is to cause a considerable movement of the contact point of the key by a slight movement of the fingers.

351,488. Reel for Electric Conductors; John M. Bowyer, Erie, Pa. For use on tables or desks or other movable objects, to admit of their being moved without severing the conductors or disturbing electrical connections.



351,388. ELECTRIC CURRENT INDICATOR.

(1) 351,524. Duplexing Railway Telegraphs; (2) 351,525. Duplexing Railway Telegraphs; Lucius J. Phelps, New York, N. Y. (1) See page 234 of this issue. (2) A modification of the first.

351,544. Dynamo-Electric Machine; Henry E. Walter, Clifton, Assignor of one-half to Charles Batchelor, New York, N. Y. Two independent continuous windings are placed upon the same armature and connected with separate commutators. The motor coil is wound over an auxiliary armature core in addition to the main core. The invention is an improvement on machines designed to serve both as motors and generators. The object is to produce a machine in which both the magnetic displacement and the self-induction of the motor and generator windings will be equal. [See illustration.]

351,569. Telephone Transmitter; Emile Berliner, Washington, D. C. The variable contact is formed of two carbon plates, one of which rests by gravity on the other, and one of which has a curved contact surface. The lower of the two plates is fixed at its edge and serves as a diaphragm. Various forms of carbon plates are shown.

351,588. Mechanical Telephone System; Moses G. Farmer, New York, N. Y. [See page 236 of this issue.]

351,589. System of Electric Distribution; Lucien Gaulard and John D. Gibbs, County of Middlesex, England, Assignors to George Westinghouse, Jr., Pittsburgh, Pa. This is a system of distribution by secondary generators or induction coils, by means of which a current of high E. M. F. and low quantity is transformed into one of low E. M. F. and greater quantity. Described in THE ELECTRICAL WORLD, Feb. 7, 1885.

351,597. Telephone System; Nicholas Conrad Heissler, St. Petersburg, Russia. The invention contemplates the placing of two sets of telephone instruments on each line, and provides an automatic switch by means of which either set may be made operative from either end to the exclusion of the other set.

351,599. Electric Vibrating Call or Signal Bell; Charles Henzel, New York, N. Y. An improvement on the invention shown and described in U. S. Patent No. 318,472.

351,600. Electrical Door Opener; Charles Henzel and William Wood, New York, N. Y. An electro-magnet, when operated by closing its circuit, releases a locking bar which engages with the detent of a door. The circuit controller may be located at any convenient point.

351,601. Electric Lamp; Warren S. Hill, Boston, Mass. The main object is to secure a practical balance of the forces acting on the feed when the lamp is in operation.

351,602. Electric Battery; Charles J. Hirlimann, New York, N. Y. The battery fluid is placed in an outer jar within which a porous cup is contained. The latter has a sealed lid, and air is admitted to it through refractory tubes which pass through the lids of both the inner cup and the outer jar. Applicable to non-acid batteries.

351,704. CONDUCTOR FOR TELEPHONES.

351,650. Electro-Magnetic Car-Brake; Harvey S. Park, Henderson, Ky. By means of electro-magnetic devices the brake-chain windlass is brought into operative connection with the axle of the car wheels.

351,697. Underground Conduit for Electric Wires; Francis V. Greene, New York, N. Y., Assignor to the Barber Asphalt Paving Co., Washington, D. C. Slabs or blocks of concrete having wire netting imbedded in them form the conduits. The wire netting serves to carry off induced currents. The conduits can be increased in size to meet the demand for additional wires.

351,699. Reversing Gear for Dynamo-Electric Machines; Edward John Houghton, Peckham, County of Surrey, and Thomas Marshall Collet, Great Winchester street, County of Middlesex, England. Improvement on invention shown and described in U. S. Patent No. 288,888.

351,702. Electric Valve; Warren S. Johnson, Whitewater, Assignor to the Johnson Electric Service Company, Milwaukee, Wis. An electric circuit controlled by the temperature of a room itself controls the action of a valve, and the latter governs the operation of a main valve by which the temperature of the room is regulated.

351,704. Conductor for Telephones; Adolphus A. Knudson, Brooklyn, N. Y. A cable composed of two or more wires of the same metal, differing in size and degree of hardness. Designed for mechanical telephone lines; the different hardness and size of wires breaks up the vibrations. See article "The Knudson and Ellsworth Acoustic Telephone," ELECTRICAL WORLD, Aug. 21, 1886.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.